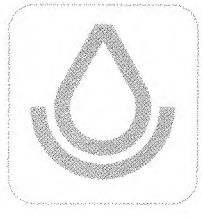
SOIL SURVEY OF

Orange County and Western Part of Riverside County, California



United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
University of California
Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1959–73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1974. This survey was made cooperatively by the Soil Conservation Service and Forest Service and the University of California Agricultural Experiment Station with financial assistance from the County of Orange. It is part of the technical assistance furnished to the Orange County, Riverside-Corona, and Elsinore-Murrieta-Anza Resource Conservation Districts.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the survey area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussion of the capability unit and the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife Habitat."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the section "Engineering."

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Orange County and Western Part of Riverside County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the area given in the section "Environmental Factors Affecting Soil Use."

Contents

	Page
Index to mapping units	iii
Summary of tables	v
How this survey was made	1
General soil map	2
Somewhat excessively drained to poorly drained, nearly level to moderately sloping soils on alluvial fans and flood plains and in basins of the coastal plains	2
1. Chino-Omni association	2
2. Hueneme-Bolsa association	3
3. Metz-San Emigdio association	3
4. Sorrento-Mocho association	3
Moderately well drained, nearly level to moderately steep soils of the coastal terraces	3
5. Myford association	4
Somewhat excessively drained and well drained, strongly sloping to very steep soils of the coastal foothills	4
6. Alo-Bosanko association	4
7. Cieneba-Anaheim-Soper association	4
Somewhat excessively drained and well drained, strongly sloping to very steep soils of the Santa Ana Mountains	4
8. Friant-Cieneba-Exchequer association	5
Well drained, gently sloping to strongly sloping soils on terraces and alluvial fans in the Santa Ana Mountains	5
9. Ramona-Hanford association	5
Descriptions of the soils	5
Alo series	7
Alo variant	8
Anaheim series	10
Balcom series	11
Beaches	12
Blasingame series	12
Bolsa series	13
Bosanko series	15
Botella series	16
Calleguas series	17
Capistrano series	18
Chesterton series	19
Chino series	20
Cieneba series	21
Corralitos series	22
Cropley series	23
Escondido series	24
Exchequer series	25
Friant series	26
Gabino series	26
Garretson series	27
Hanford series	28
Hueneme series	28
Las Posas series	29
Laughlin series	30
Marina series	31
Metz series	32
Mocho series	33
Modjeska series	34
Myford series	35
Nacimiento series	38
Omni series	38
Pits	40
Ramona series	40
Rincon series	41
Riverwash	42
Rock outcrop	42
San Andreas series	42
San Emigdio series	42
Soboba series	44
Soper series	44
Sorrento series	46
Thapto-Histic Fluvaquents	47
Tidal flats	48
Tollhouse series	48
Vista series	49
Xeralfic Arents, loamy	50
Xerorthents loamy, cut and fill areas	50
Yorba series	51
Use and management of the soils	53
Capability grouping	53
Land resource areas	54
Resource area 19	54
Resource area 20	54
Management by capability units	54
Storie index	60
Estimated yields and crop management	61
Asparagus	61
Avocados	61
Celery	61
Oranges	63
Strawberries	63
Sweet corn	64
Tomatoes	64
Range	65
Range sites	65
Wildlife habitat	68
Engineering	69
Building site development	76
Sanitary facilities	77
Construction materials	95
Water management	101
Recreation	107
Soil properties	108
Engineering properties	108
Physical and chemical properties	109
Soil and water features	120
Engineering test data	121
Formation and classification of the soils	132
Factors of soil formation	132
Parent material	132
Relief	133
Climate	133
Biological activity	140
Time	140
Classification of the soils	141
Environmental factors affecting soil use	141
Climate	144
Water supply	145
Natural vegetation	145
Transportation facilities	145
Manufacturing and business services	146
Trends in soil use	146
Literature Cited	147
Glossary	147

Issued September 1978

Index to Mapping Units

	Page
100—Alo clay, 9 to 15 percent slopes	8
101—Alo clay, 15 to 30 percent slopes	8
102—Alo clay, 30 to 50 percent slopes	8
103—Alo variant clay, 9 to 15 percent slopes	9
104—Alo variant clay, 15 to 30 percent slopes	9
105—Alo variant clay, 30 to 50 percent slopes	9
106—Anaheim loam, 15 to 30 percent slopes	10
107—Anaheim loam, 30 to 50 percent slopes	10
108—Anaheim clay loam, 15 to 30 percent slopes	10
109—Anaheim clay loam, 30 to 50 percent slopes	10
110—Anaheim clay loam, 50 to 75 percent slopes	11
111—Balcom clay loam, 9 to 15 percent slopes	11
112—Balcom clay loam, 15 to 30 percent slopes	11
113—Balcom clay loam, 30 to 50 percent slopes	11
114—Balcom-Rock outcrop complex, 15 to 50 percent slopes	12
115—Beaches	12
116—Blasingame loam, 9 to 30 percent slopes	12
117—Blasingame stony loam, 9 to 30 percent slopes	13
118—Blasingame stony loam, 30 to 65 percent slopes	13
119—Blasingame-Rock outcrop complex, 9 to 30 percent slopes	13
120—Blasingame-Vista complex, 9 to 15 percent slopes	13
121—Blasingame-Vista complex, 15 to 30 percent slopes	13
122—Bolsa silt loam	14
123—Bolsa silt loam, drained	14
124—Bolsa silty clay loam	14
125—Bolsa silty clay loam, drained	15
126—Bosanko clay, 9 to 15 percent slopes	16
127—Bosanko clay, 15 to 30 percent slopes	16
128—Bosanko clay, 30 to 50 percent slopes	16
129—Bosanko-Balcom complex, 15 to 30 percent slopes	16
130—Bosanko-Balcom complex, 30 to 50 percent slopes	16
131—Botella loam, 2 to 9 percent slopes	17
132—Botella clay loam, 2 to 9 percent slopes	17
133—Botella clay loam, 9 to 15 percent slopes	17
134—Calleguas clay loam, 50 to 75 percent slopes, eroded	18
135—Capistrano sandy loam, 2 to 9 percent slopes	19
136—Capistrano sandy loam, 9 to 15 percent slopes	19
137—Chesterton loamy sand, 2 to 15 percent slopes	20
138—Chesterton loamy sand, 15 to 30 percent slopes	20
139—Chino silty clay loam	21
140—Chino silty clay loam, drained	21
141—Cieneba sandy loam, 15 to 30 percent slopes	21
142—Cieneba sandy loam, 30 to 75 percent slopes, eroded	21
143—Cieneba-Blasingame-Rock outcrop complex, 9 to 30 percent slopes	22
144—Cieneba-Rock outcrop complex, 9 to 30 percent slopes	22
145—Cieneba-Rock outcrop complex, 30 to 75 percent slopes	22
146—Corralitos loamy sand	23
147—Corralitos loamy sand, moderately fine substratum	23
148—Cropley clay, 0 to 2 percent slopes	24
149—Cropley clay, 2 to 9 percent slopes	24
150—Escondido very fine sandy loam, 9 to 15 percent slopes	25
151—Escondido very fine sandy loam, 15 to 30 percent slopes	25
152—Exchequer-Rock outcrop complex, 30 to 75 percent slopes	25
153—Friant fine sandy loam, 30 to 70 percent slopes	26
154—Gabino gravelly clay loam, 15 to 50 percent slopes	27
155—Garretson gravelly very fine sandy loam, 2 to 9 percent slopes	27
156—Hanford sandy loam, 2 to 9 percent slopes	28
157—Hueneme fine sandy loam	29
158—Hueneme fine sandy loam, drained	29
159—Las Posas gravelly loam, 15 to 50 percent slopes	30
160—Laughlin gravelly loam, 30 to 50 percent slopes	31
161—Marina loamy sand, 0 to 2 percent slopes	32
162—Marina loamy sand, 2 to 9 percent slopes	32
163—Metz loamy sand	33
164—Metz loamy sand, moderately fine substratum	33
165—Mocho sandy loam, 0 to 2 percent slopes	34
166—Mocho loam, 0 to 2 percent slopes	34
167—Mocho loam, 2 to 9 percent slopes	34
168—Modjeska gravelly loam, 0 to 2 percent slopes	35
169—Modjeska gravelly loam, 2 to 9 percent slopes	35
170—Modjeska gravelly loam, 9 to 15 percent slopes	35
171—Modjeska gravelly loam, 15 to 30 percent slopes	35
172—Myford sandy loam, 0 to 2 percent slopes	37
173—Myford sandy loam, 2 to 9 percent slopes	37
174—Myford sandy loam, 2 to 9 percent slopes, eroded	37
175—Myford sandy loam, 9 to 15 percent slopes	37
176—Myford sandy loam, 15 to 30 percent slopes	37
177—Myford sandy loam, 9 to 30 percent slopes, eroded	37
178—Myford sandy loam, thick surface, 0 to 2 percent slopes	38
179—Myford sandy loam, thick surface, 2 to 9 percent slopes	38
180—Nacimiento clay loam, 15 to 30 percent slopes	38
181—Nacimiento clay loam, 30 to 50 percent slopes	38
182—Omni silt loam, drained	39
183—Omni clay	39
184—Omni clay, drained	39
185—Pits	40
186—Ramona fine sandy loam, 2 to 9 percent slopes	40
187—Ramona gravelly fine sandy loam, 9 to 15 percent slopes	40
188—Rincon clay loam, 2 to 9 percent slopes	41
189—Rincon clay loam, 9 to 15 percent slopes	41
190—Rincon clay loam, 15 to 30 percent slopes	41
191—Riverwash	42
192—Rock outcrop-Cieneba complex, 30 to 75 percent slopes	42
193—San Andreas sandy loam, 15 to 30 percent slopes	42
194—San Emigdio fine sandy loam, 0 to 2 percent slopes	43
195—San Emigdio fine sandy loam, 2 to 9 percent slopes	43
196—San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	43
197—Soboba gravelly loamy sand, 0 to 5 percent slopes	44
198—Soboba cobbly loamy sand, 0 to 15 percent slopes	44
199—Soper loam, 15 to 30 percent slopes	45
200—Soper loam, 30 to 50 percent slopes	45
201—Soper gravelly loam, 15 to 30 percent slopes	45
202—Soper gravelly loam, 30 to 50 percent slopes	45
203—Soper cobbly loam, 15 to 50 percent slopes	45

Page

204—Soper-Rock outcrop complex, 30 to 75 percent slopes 46
205—Sorrento sandy loam, 0 to 2 percent slopes 46
206—Sorrento loam, 0 to 2 percent slopes 47
207—Sorrento loam, 2 to 9 percent slopes 47
208—Sorrento clay loam, 0 to 2 percent slopes 47
209—Sorrento clay loam, 2 to 9 percent slopes 47
210—Thapto-Histic Fluvaquents 48
211—Tidal flats 48
212—Tollhouse-Rock outcrop complex, 30 to 75 percent slopes 49
213—Vista coarse sandy loam, 9 to 15 percent slopes 50
214—Vista coarse sandy loam, 15 to 30 percent slopes 50
215—Vista coarse sandy loam, 30 to 65 percent slopes 50
216—Vista-Rock outcrop complex, 9 to 30 percent slopes 50

Page

217—Xeralfic Arents, loamy, 2 to 9 percent slopes 50
218—Xeralfic Arents, loamy, 9 to 15 percent slopes 50
219—Xerorthents loamy, cut and fill areas, 9 to 15 percent slopes 50
220—Xerorthents loamy, cut and fill areas, 15 to 30 percent slopes 51
221—Yorba gravelly sandy loam, 2 to 9 percent slopes 52
222—Yorba gravelly sandy loam, 9 to 15 percent slopes 52
223—Yorba gravelly sandy loam, 15 to 30 percent slopes 52
224—Yorba cobbly sandy loam, 9 to 30 percent slopes 52
225—Yorba cobbly sandy loam, 9 to 30 percent slopes, eroded 52
226—Yorba cobbly sandy loam, 30 to 50 percent slopes 52

SUMMARY OF TABLES

	Page
Acreage and Proportionate extent of the Soils (Table 1) Acres. Percent.	6
Building Site Development (Table 4) Shallow excavations. Dwellings without basements. Small commercial buildings. Local roads and streets.	78
Classification of the Soils (Table 13) Soil name. Family or higher taxonomic class.	146
Construction Materials (Table 6) Roadfill. Sand. Gravel. Topsoil.	90
Engineering Properties and Classifications (Table 9) Depth. USDA texture. Classification—Unified, AASHTO. Fragments >3 inches. Percentage passing sieve numbers—4, 10, 40, 200. Liquid limit. Plasticity index.	110
Engineering Test Data (Table 12)	142
Physical and Chemical Properties of Soils (Table 10) Depth. Permeability. Available water capacity. Soil reaction. Salinity. Shrink-swell potential. Risk of corrosion—Uncoated steel, Concrete. Erosion factors—K, T.	122
Recreation (Table 8) Camp areas. Picnic areas. Playgrounds. Paths and trails.	102
Sanitary Facilities (Table 5) Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Daily cover for landfill.	84
Soil and Water Features (Table 11) Hydrologic group. Flooding—Frequency, Duration, Months. High water table—Depth, Kind, Months. Bedrock—Depth, Hardness. Cemented pan—Depth, Hardness.	134
Water Management (Table 7) Pond reservoir areas. Embankments, dikes, and levees. Drainage. Terraces and diversions. Grassed waterways.	96
Wildlife Habitat Potentials (Table 3) Potential for habitat elements—Grain and seed crops, Grasses and legumes, Wild herbaceous plants, Hardwood trees, Coniferous plants, Shrubs, Wetland plants, Shallow water areas. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife, Rangeland wildlife.	70
Yields Per Acre of Crops and Pasture (Table 2) Oranges, Valencia. Avocados. Asparagus. Celery. Strawberries. Sweet corn. Tomatoes.	62

Location of Orange County and the Western Part of Riverside County in California.

SOIL SURVEY OF ORANGE COUNTY AND WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA

BY JOHN K. WACHTELL

SOILS SURVEYED BY JOHN K. WACHTELL, DAVID D. ESTRADA, RICHARD O. HANES, DENNIS R. SMETANA, AND LESLIE W. WILLIAMS, SOIL CONSERVATION SERVICE, AND GERALD L. ANDERSON AND E. P. WAGNER, FOREST SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

ORANGE COUNTY AND THE WESTERN PART OF RIVERSIDE COUNTY are along the Southern California Coast, between Los Angeles County to the north and San Diego County to the south (see facing page). Parts of San Bernardino County and the east boundary line of the Cleveland National Forest in Western Riverside County are the eastern inland boundary. The survey area extends approximately 37 miles along the coast and reaches an average of about 20 to 22 miles inland. It covers an area of about 907 square miles, or 580,994 acres. Approximately 226 square miles, or 144,387 acres, of the Cleveland National Forest, also called the Trabuco Ranger District, Cleveland National Forest, is within the survey area. This district is in the Santa Ana Mountains adjacent to the eastern part of Orange County and the western part of Riverside County.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons in a soil. It extends from the surface down into the parent material that has not been changed by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Capistrano and Yorba, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Capistrano sandy loam, 2 to 9 percent slopes, is one of several phases in the Capistrano series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show brushlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen on an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Only one such kind of mapping unit, a soil complex, is shown on the soil map of the survey area.

A soil complex consists of two or more soils, so intricately intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Bosanko-Balcom complex, 15 to 30 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, shallow, or severely eroded

that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous areas and are given descriptive names. Riverwash is an example in the survey area.

While a soil survey is in progress, samples of soils are taken for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all soils.

Soil scientists observe how soils behave when used as a growing medium for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, observations and knowledge of soil properties are used with available research data to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that finally evolve reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Orange County and the Western Part of Riverside County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field; or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey have been grouped into five general kinds of landscapes for interpretive purposes. Each group and the soil associations in that group are described on the following pages. The terms for texture used in the title for several of the associations refer to the texture of the surface layer. For example, in the title of association 1, the words, "silt loams to clays" refer to the texture of the surface layer.

Somewhat Excessively Drained to Poorly Drained, Nearly Level to Moderately Sloping Soils on Alluvial Fans and Flood Plains and in Basins of the Coastal Plains

The four soil associations in this group make up about 39 percent of the survey area. They are on alluvial fans, on flood plains, and in small basins. The soils are somewhat excessively drained to poorly drained loamy sands to clays that formed mostly in mixed alluvium, dominantly from sedimentary rock sources.

Elevation ranges from near sea level to 1,500 feet. The average annual rainfall is 12 to 18 inches, and the average annual air temperature is 59 to 62° F. The frost-free season is 270 to 355 days.

These associations are used extensively for truck crops, specialty crops, and field crops. They are also used extensively for urban purposes.

1. Chino-Omni association

Nearly level, somewhat poorly drained and poorly drained, calcareous silt loams to clays on alluvial fans and flood plains and in basins

This association is mainly in an area about 6 to 9 miles inland from the seacoast, northeast of Costa Mesa. A smaller area is about halfway between Huntington Beach and Sunset Beach. Another small area is on the southwest side of Buena Park. These areas are mainly basins at the lower ends of the flood plains. The soils formed in very deep alluvium. Slopes are 0 to 2 percent. The plant cover is annual grasses, forbs, mustard, and salt-tolerant plants that require moisture. Elevations range from near sea level to 200 feet. The average annual rainfall is 12 to 15 inches, the average air temperature is about 61° F., and the frost-free season is 280 to 350 days.

This association occupies 5 percent of the survey area. It is about 55 percent Chino soils; 35 percent Omni soils; and 10 percent Bolsa, Mocho, and Sorrento soils and Tidal flats.

Chino soils are more than 60 inches deep and are somewhat poorly drained. Most of these soils now have altered drainage, and the water table is deeper than 5 feet. They have a gray silty clay loam surface layer underlain by gray and grayish brown silty clay loam that has some light brownish gray mottles. The underlying material is light gray silty clay loam and sandy clay loam. These soils are moderately alkaline and calcareous throughout.

Omni soils are more than 60 inches deep, are calcareous clay throughout, and are poorly drained. Most of these soils also have altered drainage and a water table deeper than 5 feet, and the saline-alkali salts has been reduced from moderate to slight or none.

They have a gray surface layer underlain by a light gray subsoil with olive brown mottles. The substratum is dark gray and mottled.

These soils are commonly used for celery, tomatoes, and barley. Many areas are now urbanized.

2. *Hueneme-Bolsa association*

Nearly level, poorly drained and somewhat poorly drained, calcareous fine sandy loams, silt loams, and silty clay loams on alluvial fans and flood plains

This association is mainly on flood plains. It extends from Seal Beach southeast to the Santa Ana River and about 10 to 12 miles inland from the coast. The soils formed in very deep alluvium. Slopes are 0 to 2 percent. The plant cover is annual grasses and forbs, mustard, and plants that require moisture. Elevation ranges from 5 to 350 feet. The average annual rainfall is 12 to 15 inches, and the average annual air temperature is 61 to 62° F. The frost-free season is 300 to 350 days.

This association occupies 11 percent of the survey area. It is about 45 percent Hueneme soils; 40 percent Bolsa soils; and 15 percent Chino, Omni, and San Emigdio soils and Tidal flats.

Hueneme soils are more than 60 inches deep and are poorly drained. Most of these soils have altered drainage and a water table deeper than 5 feet. They have a light brownish gray fine sandy loam surface layer underlain by light gray loamy sand. The underlying material is light brownish gray silt loam, loamy fine sand, fine sandy loam, and silty clay loam. Most of this material is mottled. The soils are moderately alkaline and calcareous throughout.

Bolsa soils are more than 60 inches deep and somewhat poorly drained. Most of these soils have altered drainage and a water table deeper than 5 feet. They have a light brownish gray silt loam or silty clay loam surface layer underlain by light brownish gray silt loam and silty clay loam that is mottled in places. They are moderately alkaline throughout and calcareous to a depth of 40 inches or more.

This association is commonly used for truck crops, field crops, and urban development.

3. *Metz-San Emigdio association*

Nearly level, somewhat excessively drained and well drained, calcareous loamy sands and fine sandy loams on alluvial fans and flood plains

This association is mainly on the upper flood plains from the Santa Ana Canyon area west to near Buena Park and Stanton, and southwest to near Garden Grove and the northern part of Santa Ana. Smaller areas also occur on the flood plains near Tustin southeast of Borrego Canyon. The soils formed in very deep alluvium. Slopes are 0 to 9 percent. The plant cover is annual grasses and forbs. Elevation ranges from 10 to 1,500 feet. The average annual rainfall is 12 to 18 inches, the average annual air temperature is about 62° F., and the frost-free season is 270 to 350 days.

This association occupies 14 percent of the survey area. It is about 45 percent Metz soils; about 40 percent San Emigdio soils; and 15 percent Capistrano, Corralitos, Hueneme, Mocho, and Soboba soils and Riverwash.

Metz soils are more than 60 inches deep and are somewhat excessively drained. They have a pale brown loamy sand surface layer underlain by stratified brown, pale brown, and very pale brown loamy sands and sandy loams. They are moderately alkaline and generally calcareous throughout.

San Emigdio soils are more than 60 inches deep and are well drained. They have a light brownish gray fine sandy loam surface layer. The underlying material is stratified, very pale brown, light gray, and pale brown gravelly loamy coarse sand to very fine sandy loam. These soils are moderately alkaline and calcareous throughout.

This association is used for strawberries, citrus, row crops, field crops, and urban development.

4. *Sorrento-Mocho association*

Nearly level to moderately sloping, well drained sandy loams, loams, or clay loams on alluvial fans and flood plains

This association is mainly on the upper flood plains and on alluvial fans near the foothills. Slopes are 0 to 9 percent. The plant cover is annual grasses and forbs and in some areas a few sycamore trees. Elevation ranges from 50 to 700 feet. The average annual rainfall is 12 to 16 inches, and the average annual air temperature is 59 to 62° F. The frost-free season is 270 to 355 days.

This association occupies 9 percent of the survey area. It is about 55 percent Sorrento soils; 35 percent Mocho soils; and 10 percent Bolsa, Botella, Chino, and San Emigdio soils.

Sorrento soils are more than 60 inches deep and are well drained. They have a grayish brown sandy loam, loam, or clay loam surface layer underlain by grayish brown, light brownish gray, and pale brown silty clay loam. They are neutral at the surface and become moderately alkaline and calcareous with increasing depth.

Mocho soils are more than 60 inches deep and are well drained. They have a brown and grayish brown sandy loam or loam surface layer underlain by light brownish gray, brown, and pale brown stratified fine sandy loam, light silty clay loam, and heavy loam. They are moderately alkaline and calcareous throughout.

This association is used for a variety of irrigated crops, for citrus, and urban development.

Moderately Well Drained, Nearly Level to Moderately Steep Soils of the Coastal Terraces

The one soil association in this group makes up about 10 percent of the survey area. It is on terraces, older alluvial fans, and remnants in the coastal foothills. The soils are moderately well drained sandy loams that have a well defined subsoil that developed from sandy sediments.

Elevation ranges from 50 to 1,500 feet. The average annual rainfall is 12 to 20 inches, and the average annual air temperature is about 62° F. The frost-free season is 270 to 350 days.

This association is used mainly for pasture, range, barley, and urban development.

5. *Myford association*

Nearly level to moderately steep, moderately well drained sandy loams that have a strongly developed subsoil; on terraces

This association is mainly along the coastline up to 5 miles inland and along lower edges of the foothills. The soils formed in sandy sediments mostly on marine terraces. They are also on older alluvial fans and terrace remnants in the foothills. Slopes are 0 to 30 percent. The plant cover generally is annual grasses and forbs and in some areas scattered brush. Elevation ranges from 50 to 1,500 feet. The average annual rainfall is 12 to 20 inches and the average annual air temperature is about 62° F. The frost-free season is 270 to 350 days.

This association occupies 10 percent of the survey area. It is about 80 percent Myford soils and 20 percent Capistrano, Chesterton, Marina, and Yorba soils.

Myford soils are moderately well drained. The surface layer is pale brown and pinkish gray sandy loam. The subsoil is brown and light brown sandy clay and sandy clay loam. The substratum is very pale brown sandy loam to a depth of more than 60 inches.

These soils are used mostly for pasture, range, and urban development.

Somewhat Excessively Drained and Well Drained, Strongly Sloping to Very Steep Soils of the Coastal Foothills

The two soil associations in this group make up about 25 percent of the survey area. They are in sedimentary deposits of the coastal foothills.

Elevation ranges from 100 to 4,000 feet. The average annual rainfall is 12 to 25 inches, and the average annual air temperature is 59 to 62° F. The frost-free season is 200 to 350 days.

These associations are used mainly for pasture and range. The better sites are in barley or irrigated citrus. Some areas are used for urban development.

6. *Alo-Bosanko association*

Strongly sloping to steep, well drained clays on coastal foothills

This association is northeast of the coastal terraces in the San Clemente to Corona Del Mar areas to the Santa Ana Mountains; northeast of the flood plains and terraces of the El Toro to the Orange cities area; and north of flood plains and terraces in the Anaheim to Buena Park areas to the Los Angeles and San Bernardino County lines. The soils formed in material weathered from calcareous sandstone and shale. Slopes are 9 to 50 percent. The plant cover consists of annual grasses, mustard, and other forbs. Elevation ranges from 200 to 2,500 feet. The average annual rainfall is 12 to 20 inches, and the average annual air temperature is 59 to 62°F. The frost-free season is 300 to 350 days.

This association occupies 10 percent of the survey area. It is about 55 percent Alo soils; 25 percent Bosanko soils; and 20 percent the Alo variant and Anaheim, Balcom, Calleguas, and San Andreas soils.

Alo soils are well drained. They have a dark grayish brown clay surface layer. At a depth of 24 to 40 inches is weathered shale or sandstone, or both. Bosanko soils also are well drained. They have a dark gray clay surface layer. At a depth of 22 to 38 inches is weathered shale or sandstone or both.

This association is used mostly for barley, pasture, and range. Citrus is grown on some of the better sites. Some areas are used for urban development.

7. *Cieneba-Anaheim-Soper association*

Strongly sloping to very steep, somewhat excessively drained and well drained sandy loams, loams, clay loams, gravelly loams, and cobbly loams on coastal foothills

This association is in the foothills between Corona Del Mar and San Clemente east and northeast to the Santa Ana Mountains, east and northeast of the terraces and flood plains from El Toro to Tustin and Orange, and northeast and north of the terraces and flood plains near Anaheim to Buena Park to the Los Angeles and San Bernardino County lines. The soils formed in material weathered from sandstone, shale, and conglomerate. Slopes are 9 to 75 percent. The plant cover is brush and annual grasses and forbs. Elevation ranges from 100 to 4,000 feet. The average annual air temperature is 59 to 62° F., and the frost-free season is 200 to 350 days.

This association occupies 15 percent of the survey area. It is about 40 percent Cieneba soils; 30 percent Anaheim soils; 15 percent Soper soils; and 15 percent Alo, Balcom, Calleguas, Gabino, Nacimiento, San Andreas, and Yorba soils.

Cieneba soils are somewhat excessively drained. They have a light brownish gray and pale brown sandy loam surface layer 5 to 19 inches thick underlain by soft sandstone.

Anaheim soils are well drained and have a grayish brown loam or clay loam surface layer 20 to 36 inches thick. The underlying material is weathered sandstone or shale or both.

Soper soils are well drained and typically have a brown loam, gravelly loam, or cobbly loam surface layer and a reddish brown gravelly clay loam subsoil. At a depth of 20 to 32 inches is weathered conglomerate or sandstone or both.

This association is used mainly for range. Some areas are used for urban development.

Somewhat Excessively Drained and Well Drained, Strongly Sloping to Very Steep Soils of the Santa Ana Mountains

The one association in this group makes up about 25 percent of the survey area. It is in the mountains, on uplands. The soils are somewhat excessively drained and well drained sandy loams and silt loams that formed in material weathered mostly from granitic, metabasic, and metasedimentary rocks.

Elevation ranges from 1,000 to 4,000 feet. The average annual precipitation, mainly rainfall, is 16 to 25 inches, and the average annual air temperature is about 59°F. The frost-free season is 210 to 300 days.

This association is used mainly for wildlife habitat,

watershed, and recreation and to a limited extent for range.

8. *Friant-Cieneba-Exchequer association*

Strongly sloping to very steep, somewhat excessively drained and well drained fine sandy loams, sandy loams, and gravelly silt loams on mountains

This association consists of soils that formed in material weathered from granitic, metabasic, and metasedimentary rock. Slopes are 9 to 75 percent. The plant cover is mainly brush. Elevation ranges from 1,000 to 4,000 feet. The average annual precipitation, mostly rainfall, is 14 to 25 inches, the average annual air temperature is about 59 to 62°F., and the frost-free season is 200 to 340 days.

This association occupies 25 percent of the survey area. It is about 40 percent Friant soils; about 35 percent Cieneba soils; about 15 percent Exchequer soils; and 10 percent Blasingame, Escondido, Laughlin, Tollhouse, and Vista soils.

Friant soils are somewhat excessively drained. They have a brown fine sandy loam surface layer 9 to 18 inches thick. They are underlain by fractured hard metasedimentary rock.

Cieneba soils are somewhat excessively drained. They have a light brownish gray and pale brown sandy loam surface layer 5 to 19 inches thick. They are underlain by weathered granodiorite. In places rock outcrop and large boulders cover more than 50 percent of the surface area.

Exchequer soils are well drained to somewhat excessively drained. They have a reddish brown gravelly silt loam surface layer 8 to 18 inches thick. They are underlain by fractured metabasic rock. About 10 percent of the surface area is low rock outcrop.

Well Drained, Gently Sloping to Strongly Sloping Soils on Terraces and Alluvial Fans in the Santa Ana Mountains

The one association in this group makes up about 1 percent of the survey area. It is on terraces and alluvial fans and in small narrow valleys on the east side of the Santa Ana Mountains. The soils are well drained sandy loams, gravelly fine sandy loams, or fine sandy loams that formed in alluvium derived mostly from granite.

Elevation ranges from 700 to 1,500 feet. The average annual rainfall is 12 to 16 inches, and the average annual air temperature is about 63°F. The frost-free season is 250 to 280 days.

This association is used for citrus, wildlife habitat, and watershed and to a limited extent for pasture or range.

9. *Ramona-Hanford association*

Gently sloping to strongly sloping, well drained fine sandy loams, gravelly fine sandy loams, and sandy loams on terraces and alluvial fans

This association consists of soils that formed in alluvium derived mostly from granite. Slopes are 2 to 15 percent. The plant cover is mainly brush or light brush, annual grasses, and forbs. Elevation ranges from 700 to 1,500 feet. The average annual rainfall is 12 to 16 inches, and the average annual air temperature is about 63° F. The frost-free season is 250 to 280 days.

This association occupies 1 percent of the survey area. It is about 45 percent Ramona soils; 35 percent Hanford soils; and 20 percent Corralitos, Modjeska, Soboba, and Yorba soils and Riverwash.

Ramona soils are well drained. They have a brown fine sandy loam or gravelly fine sandy loam surface layer. The subsoil is brown sandy clay loam. The substratum to a depth of 60 inches or more is brown fine sandy loam. Hanford soils are well drained. The surface layer is grayish brown sandy loam. The underlying material to a depth of 60 inches and more is pale brown and grayish brown sandy loam and a few strata of gravel and loamy sand.

This association is used for citrus and to a limited extent for pasture or range.

Descriptions of the Soils

This section describes in detail the soils of Orange County and Western Part of Riverside County and their use. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman; the second is more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the soil series is representative of mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are either stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil is used.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Beaches, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order with the soil series.

Preceding the name of each mapping unit is a numerical symbol. This symbol identifies the mapping unit on the detailed soil map. At the end of each description of a mapping unit is the capability unit to which the soil is assigned, the range site, and the Storie index rating.

In the locations of the typical profiles, some sections are designated "by private survey." According to the geological survey topographic maps, the top edge of these sections is to the northwest, not to the north.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used

TABLE 1.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent
100	Alo clay, 9 to 15 percent slopes	5,445	0.9
101	Alo clay, 15 to 30 percent slopes	10,930	1.9
102	Alo clay, 30 to 50 percent slopes	10,530	1.8
103	Alo Variant clay, 9 to 15 percent slopes	240	(1)
104	Alo Variant clay, 15 to 30 percent slopes	1,165	0.2
105	Alo Variant clay, 30 to 50 percent slopes	620	0.1
106	Anaheim loam, 15 to 30 percent slopes	1,490	0.3
107	Anaheim loam, 30 to 50 percent slopes	2,605	0.4
108	Anaheim clay loam, 15 to 30 percent slopes	2,655	0.5
109	Anaheim clay loam, 30 to 50 percent slopes	5,955	1.0
110	Anaheim clay loam, 50 to 75 percent slopes	2,980	0.5
111	Balcom clay loam, 9 to 15 percent slopes	830	0.1
112	Balcom clay loam, 15 to 30 percent slopes	2,475	0.4
113	Balcom clay loam, 30 to 50 percent slopes	3,080	0.5
114	Balcom-Rock outcrop complex, 15 to 50 percent slopes	710	0.1
115	Beaches	3,530	0.6
116	Blasingame loam, 9 to 30 percent slopes	1,490	0.3
117	Blasingame stony loam, 9 to 30 percent slopes	1,045	0.2
118	Blasingame stony loam, 30 to 65 percent slopes	5,090	0.9
119	Blasingame-Rock outcrop complex, 9 to 30 percent slopes	510	0.1
120	Blasingame-Vista complex, 9 to 15 percent slopes	485	0.1
121	Blasingame-Vista complex, 15 to 30 percent slopes	985	0.2
122	Bolsa silt loam	920	0.2
123	Bolsa silt loam, drained	13,520	2.3
124	Bolsa silty clay loam	1,015	0.2
125	Bolsa silty clay loam, drained	4,685	0.8
126	Bosanko clay, 9 to 15 percent slopes	1,555	0.3
127	Bosanko clay, 15 to 30 percent slopes	4,720	0.8
128	Bosanko clay, 30 to 50 percent slopes	3,855	0.7
129	Bosanko-Balcom complex, 15 to 30 percent slopes	2,425	0.4
130	Bosanko-Balcom complex, 30 to 50 percent slopes	680	0.1
131	Botella loam, 2 to 9 percent slopes	1,405	0.2
132	Botella clay loam, 2 to 9 percent slopes	1,675	0.3
133	Botella clay loam, 9 to 15 percent slopes	1,510	0.3
134	Calleguas clay loam, 50 to 75 percent slopes, eroded	34,505	5.9
135	Capistrano sandy loam, 2 to 9 percent slopes	5,510	0.9
136	Capistrano sandy loam, 9 to 15 percent slopes	2,075	0.4
137	Chesterton loamy sand, 2 to 15 percent slopes	400	0.1
138	Chesterton loamy sand, 15 to 30 percent slopes	125	(1)
139	Chino silty clay loam	1,795	0.3
140	Chino silty clay loam, drained	10,015	1.7
141	Cieneba sandy loam, 15 to 30 percent slopes	2,785	0.5
142	Cieneba sandy loam, 30 to 75 percent slopes, eroded	40,525	7.0
143	Cieneba-Blasingame-Rock outcrop complex, 9 to 30 percent slopes	3,490	0.6
144	Cieneba-Rock outcrop complex, 9 to 30 percent slopes	1,600	0.3
145	Cieneba-Rock outcrop complex, 30 to 75 percent slopes	37,461	6.4
146	Corralitos loamy sand	2,770	0.5
147	Corralitos loamy sand, moderately fine substratum	480	0.1
148	Cropley clay, 0 to 2 percent slopes	1,005	0.2
149	Cropley clay, 2 to 9 percent slopes	3,485	0.6
150	Escondido very fine sandy loam, 9 to 15 percent slopes	415	0.1
151	Escondido very fine sandy loam, 15 to 30 percent slopes	950	0.2
152	Exchequer-Rock outcrop complex, 30 to 75 percent slopes	19,270	3.3
153	Friant fine sandy loam, 30 to 70 percent slopes	49,740	8.6
154	Gabino gravelly clay loam, 15 to 50 percent slopes	4,655	0.8
155	Garretson gravelly very fine sandy loam, 2 to 9 percent slopes	90	(1)
156	Hanford sandy loam, 2 to 9 percent slopes	520	0.1
157	Hueneme fine sandy loam	495	0.1
158	Hueneme fine sandy loam, drained	23,705	4.1
159	Las Posas gravelly loam, 15 to 50 percent slopes	970	0.2
160	Laughlin gravelly loam, 30 to 50 percent slopes	2,145	0.4
161	Marina loamy sand, 0 to 2 percent slopes	565	0.1
162	Marina loamy sand, 2 to 9 percent slopes	4,000	0.7
163	Metz loamy sand	20,755	3.6
164	Metz loamy sand, moderately fine substratum	9,310	1.6
165	Mocho sandy loam, 0 to 2 percent slopes	1,090	0.2
166	Mocho loam, 0 to 2 percent slopes	12,375	2.1
167	Mocho loam, 2 to 9 percent slopes	2,415	0.4
168	Modjeska gravelly loam, 0 to 2 percent slopes	2,380	0.4
169	Modjeska gravelly loam, 2 to 9 percent slopes	2,395	0.4
170	Modjeska gravelly loam, 9 to 15 percent slopes	635	0.1
171	Modjeska gravelly loam, 15 to 30 percent slopes	785	0.1
172	Myford sandy loam, 0 to 2 percent slopes	4,405	0.8
173	Myford sandy loam, 2 to 9 percent slopes	20,910	3.6
174	Myford sandy loam, 2 to 9 percent slopes, eroded	2,285	0.4

TABLE 1.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Acres	Percent	Map symbol	Soil name	Acres	Percent
175	Myford sandy loam, 9 to 15 percent slopes	6,180	1.1	202	Soper gravelly loam, 30 to 50 percent slopes	3,445	0.6
176	Myford sandy loam, 15 to 30 percent slopes	2,140	0.4	203	Soper cobbly loam, 15 to 50 percent slopes	1,170	0.2
177	Myford sandy loam, 9 to 30 percent slopes, eroded	4,420	0.8	204	Soper-Rock outcrop complex, 30 to 75 percent slopes	1,590	0.3
178	Myford sandy loam, thick surface, 0 to 2 percent slopes	3,775	0.6	205	Sorrento sandy loam, 0 to 2 percent slopes	785	0.1
179	Myford sandy loam, thick surface, 2 to 9 percent slopes	2,960	0.5	206	Sorrento loam, 0 to 2 percent slopes	6,275	1.1
180	Nacimiento clay loam, 15 to 30 percent slopes	630	0.1	207	Sorrento loam, 2 to 9 percent slopes	4,960	0.8
181	Nacimiento clay loam, 30 to 50 percent slopes	670	0.1	208	Sorrento clay loam, 0 to 2 percent slopes	7,095	1.2
182	Omni silt loam, drained	1,320	0.2	209	Sorrento clay loam, 2 to 9 percent slopes	3,080	0.5
183	Omni clay	190	(1)	210	Thapto-Histic Fluvaquents	310	0.1
184	Omni clay, drained	7,105	1.2	211	Tidal flats	3,045	0.5
185	Pits	1,890	0.3	212	Tollhouse-Rock outcrop complex, 30 to 75 percent slopes	2,280	0.4
186	Ramona fine sandy loam, 2 to 9 percent slopes	455	0.1	213	Vista coarse sandy loam, 9 to 15 percent slopes	245	(1)
187	Ramona gravelly fine sandy loam, 9 to 15 percent slopes	355	0.1	214	Vista coarse sandy loam, 15 to 30 percent slopes	215	(1)
188	Rincon clay loam, 2 to 9 percent slopes	700	0.1	215	Vista coarse sandy loam, 30 to 65 percent slopes	440	0.1
189	Rincon clay loam, 9 to 15 percent slopes	310	0.1	216	Vista-Rock outcrop complex, 9 to 30 percent slopes	935	0.2
190	Rincon clay loam, 15 to 30 percent slopes	280	(1)	217	Xeralfic Arents, loamy, 2 to 9 percent slopes	735	0.1
191	Riverwash	6,165	1.1	218	Xeralfic Arents, loamy, 9 to 15 percent slopes	820	0.1
192	Rock outcrop-Cieneba complex, 30 to 75 percent slopes	17,938	3.1	219	Xerorthents loamy, cut and fill areas, 9 to 15 percent slopes	1,095	0.2
193	San Andreas sandy loam, 15 to 30 percent slopes	1,205	0.2	220	Xerorthents loamy, cut and fill areas, 15 to 30 percent slopes	1,915	0.3
194	San Emigdio fine sandy loam, 0 to 2 percent slopes	15,775	2.7	221	Yorba gravelly sandy loam, 2 to 9 percent slopes	1,480	0.3
195	San Emigdio fine sandy loam, 2 to 9 percent slopes	1,000	0.2	222	Yorba gravelly sandy loam, 9 to 15 percent slopes	880	0.1
196	San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes	7,420	1.3	223	Yorba gravelly sandy loam, 15 to 30 percent slopes	550	0.1
197	Soboba gravelly loamy sand, 0 to 5 percent slopes	2,520	0.4	224	Yorba cobbly sandy loam, 9 to 30 percent slopes	1,160	0.2
198	Soboba cobbly loamy sand, 0 to 15 percent slopes	4,540	0.8	225	Yorba cobbly sandy loam, 9 to 30 percent slopes, eroded	1,690	0.3
199	Soper loam, 15 to 30 percent slopes	735	0.1	226	Yorba cobbly sandy loam, 30 to 50 percent slopes	2,169	0.4
200	Soper loam, 30 to 50 percent slopes	1,405	0.2		Water	1,406	0.2
201	Soper gravelly loam, 15 to 30 percent slopes	1,045	0.2		Total	580,994	100.0

[1] Less than 0.1 percent.

in describing the soils can be found in the Glossary. More detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

Alo Series

The Alo series consists of well drained soils in the foothills. These soils formed in material weathered from calcareous sandstone and shale. Slopes are 9 to 50 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is annual grasses, mustard, and other forbs. Precipitation is 12 to 20 inches. The average annual air temperature is 59 to 62° F. The frost-free season is 300 to 350 days.

In a typical profile the surface layer is dark grayish brown clay 25 inches thick. Soft lime masses occur below a depth of 15 inches. The underlying material is light yellowish brown lime coated weathered shale.

The soil is slightly acid to moderately alkaline. It is slowly permeable.

Alo soils are used for range, dryland barley, dryland pasture, irrigated citrus, and urban development.

Typical profile of Alo clay, 9 to 15 percent slopes, in Orange County, University of California Irvine property, about 2,000 feet east-southeast of the intersection

[1] Italic numbers in parentheses refer to Literature Cited, p. 147.

of McArthur Boulevard and Bonta Canyon Drive, S1/4-E1/4 sec. 90 (by private survey), T. 6 S., R. 9 W., SBB&M.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong coarse granular structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine and fine tubular pores; slightly acid; abrupt smooth boundary.

A12—2 to 15 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong very coarse prismatic structure; extremely hard, firm, very sticky and very plastic; common very fine roots; few very fine tubular pores; neutral; clear smooth boundary.

A13ca—15 to 25 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure; very hard, firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; common small few medium intersecting slickensides; cracks ½ inch wide to 25 inches from surface; strongly effervescent; medium sized rounded soft masses of lime; moderately alkaline; clear wavy boundary.

Cr1—25 to 41 inches; light yellowish brown (2.5Y 6/4) weathered shale, light olive brown (2.5Y 5/4) moist; massive; very hard; very few fine roots along fractures; lime occurs on fractures; strongly effervescent; shale is slightly acid; clear wavy boundary.

Cr2—41 to 59 inches; mixed yellow (2.5Y 7/6), light yellowish brown (2.5Y 6/4), and light gray (10YR 7/2) weathered interbedded shale and sandstone; olive yellow (2.5Y 6/6), light olive brown (2.5Y 5/4), and light brownish gray (10YR 6/2) moist; few lime coatings on shale fractures; slightly acid.

Depth to weathered sandstone or shale, or both, is 24 to 40 inches.

The A horizon ranges from very dark grayish brown to brown in 10YR hue. Texture is heavy clay loam or clay. Structure ranges from granular in the upper few inches to prismatic or angular blocky. Reaction ranges from slightly acid to moderately alkaline. Thickness ranges from 14 to 25 inches.

Color and texture of the Aca horizon are about the same as in the A horizon. Structure is prismatic or angular blocky. Dry consistence is very hard or extremely hard. Carbonate content ranges from strongly effervescent to violently effervescent. Lime ranges from few to many medium to large soft masses. Thickness ranges from 10 to 15 inches.

The Cr horizon can be easily cut with hand tools.

Cracks more than ½ inch wide occur to a depth of 20 inches or more during the dry season.

100—Alo clay, 9 to 15 percent slopes. This strongly sloping soil generally occurs on ridges and toe slopes in the foothills. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Bosanko clay, 9 to 15 percent slopes; 5 percent Anaheim clay loam; and 3 percent Balcom clay loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 3.5 to 7.0 inches. The effective rooting depth is 25 to 40 inches.

Present land use is citrus, dryland barley, pasture, range, and urban development. Capability unit IIIe–5 (19); Clayey range site; Storie index 33.

101—Alo clay, 15 to 30 percent slopes. This moderately steep soil generally occurs on broad ridgetops in the foothills. The profile is similar to the one described as typical of the series, but it is slightly shallower.

About 5 percent of this mapping unit is included areas of Bosanko clay, 15 to 30 percent slopes; 5 percent Anaheim clay loam, 15 to 30 percent slopes; 3 percent Balcom clay loam, 15 to 30 percent slopes; and 2 percent gravelly soils on some ridgetops.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.5 to 6.0 inches. The effective rooting depth is 24 to 36 inches.

Present land use is dryland barley, pasture, range, and urban development. Capability unit IVe–5 (19); Clayey range site; Storie index 23.

102—Alo clay, 30 to 50 percent slopes. This steep soil generally occurs on side slopes in the foothills. The profile is similar to the one described as typical of the series, but it is somewhat shallower.

About 5 percent of this mapping unit is included areas of Anaheim clay loam, 30 to 50 percent slopes; 5 percent Calleguas clay loam, 50 to 75 percent slopes, eroded; 2 percent Balcom clay loam, 30 to 50 percent slopes; and 2 percent Bosanko clay, 30 to 50 percent slopes.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.5 to 5.5 inches. The effective rooting depth is 24 to 32 inches.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 12.

Alo Variant

The Alo variant consists of well drained soils on uplands. These soils formed in material weathered from calcareous sandstone and shale. Slopes are 9 to 50 percent. Elevation ranges from 200 to 700 feet. The vegetation is annual grasses, mustard, and other forbs. Precipitation is 12 to 16 inches, mean annual air temperature is 59 to 62° F., and the frost-free season is 280 to 350 days.

In a typical profile the upper 26 inches is reddish brown light clay. The next 14 inches is reddish brown calcareous light clay with 10 to 20 percent lime threads and soft lime masses. The underlying material is fractured weathered soft sandstone and shale to a depth of 66 inches or more; the upper 8 inches is coated with lime threads and soft lime masses.

The soil is slightly acid in the upper part, moderately alkaline in the next layer and in the upper part of the weathered bedrock, and neutral and noncalcareous in the underlying sandstone and shale. It is slowly permeable.

The Alo variant is used for citrus, dryland barley, range, dryland pasture, and urban development.

Typical profile of Alo variant clay, 9 to 15 percent slopes, in NW¼SE¼ sec. 29, T. 6 S., R. 7 W. SBB&M; about 150 feet south of the Veeh Ranch lemon orchard, 350 feet elevation, on a south-facing slope:

A11—0 to 2 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/3) moist; strong medium subangular blocky structure; hard, firm, very sticky and plastic; common very fine roots; common very fine tubular pores; slightly acid; abrupt smooth boundary.

A12—2 to 6 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/3) moist; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; many very fine roots; many very fine tubular pores; common slickensides; slightly acid; clear wavy boundary.

A13—6 to 18 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/3) moist; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine and fine roots; few very fine and fine tubular pores; common intersecting slickensides; slightly acid; clear wavy boundary.

A14—18 to 26 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/3) moist; strong coarse angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; common intersecting slickensides; neutral; clear wavy boundary.

A15ca—26 to 34 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/4) moist; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine tubular pores; few slickensides; violently effervescent; 10 percent very fine lime threads; moderately alkaline; clear wavy boundary.

A16ca—34 to 40 inches; reddish brown (5YR 4/3) light clay, dark reddish brown (5YR 3/4) moist; strong medium and coarse angular blocky structure; very hard, very firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; few slickensides; violently effervescent; 20 percent very fine lime threads and medium irregularly shaped soft lime masses; moderately alkaline; abrupt smooth boundary.

Cr1—40 to 48 inches; fractured weathered sandstone; few very fine roots on fractures; many very fine and fine interstitial pores; violently effervescent; lime threads and soft masses mostly on 50 percent of the fractures; few pockets of A horizon material; moderately alkaline; gradual wavy boundary.

Cr2—48 to 54 inches; fractured weathered sandstone; neutral; abrupt wavy boundary.

Cr3—54 to 66 inches; weathered soft interbedded sandstone and shale.

The A horizon ranges from dark reddish gray to reddish brown or brown in 5YR and 7.5YR hue. Texture is heavy clay loam or clay. Structure ranges from granular or subangular blocky in the upper few inches to angular blocky or prismatic, or both, in the lower parts. Dry consistence ranges from hard to extremely hard. Reaction ranges from slightly acid to moderately alkaline.

The lower Aca or ACca horizon is moderately alkaline, is calcareous, and contains segregated lime. Thickness ranges from 24 to 40 inches.

The Cr horizon is weathered sandstone and shale. It is moderately alkaline. It commonly has segregated lime in the upper few inches, but is neutral and lacks lime in lower parts.

When dry, the soil has cracks more than ½ inch wide to a depth of more than 25 inches.

103—Alo variant clay, 9 to 15 percent slopes. This strongly sloping soil generally occurs on the gentler side slopes in the foothills. It has the profile described as typical of the series.

About 3 percent of this mapping unit is included areas of Yorba gravelly sandy loam, 9 to 15 percent slopes; 3 percent Myford sandy loam, 9 to 15 percent slopes; 5 percent Bosanko clay, 9 to 15 percent slopes; and 10 percent soils that are calcareous throughout but are otherwise similar to this Alo variant clay.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 3.0 to 7.0 inches. The effective rooting depth is 26 to 40 inches.

Present land use is citrus, pasture, range, and urban development. Capability unit IIIe–5 (19); Clayey range site; Storie index 36.

104—Alo variant clay, 15 to 30 percent slopes. This moderately steep soil generally occurs on broad ridgetops in the foothills. The profile is similar to the one described as typical of the series, but it is slightly shallower.

About 3 percent of this mapping unit is included areas of Myford sandy loam; 2 percent Anaheim clay loam, 15 to 30 percent slopes; 5 percent Bosanko clay, 15 to 30 percent slopes; and 20 percent soils that are calcareous throughout but are otherwise similar to this Alo variant clay.

If the soil is bare, runoff is rapid and the erosion hazard high. Available water capacity is 4.0 to 6.0 inches. The effective rooting depth is 26 to 36 inches.

Present land use is citrus, pasture, range, and urban development. Capability unit IVe–5 (19); Clayey range site; Storie index 25.

105—Alo variant clay, 30 to 50 percent slopes. This steep soil generally occurs as irregularly shaped areas 20 to 100 acres in size. The profile is similar to the one described as typical of the series, but it is slightly shallower.

About 5 percent of this mapping unit is included areas of Bosanko clay, 30 to 50 percent slopes; 5 percent Calleguas clay loam, 50 to 75 percent slopes; and

20 percent soils that are calcareous throughout but are otherwise similar to this Alo variant clay.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.0 to 5.0 inches. The effective rooting depth is 24 to 32 inches.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 13.

Anaheim Series

The Anaheim series consists of well drained soils on foothills. These soils formed in material weathered from soft sandstone or shale. Slopes are 15 to 75 percent. Elevation ranges from 100 to 2,500 feet. The vegetation is sage, flattop buckwheat, sumac, other brush, mustard, and live oak and an undercover of annual grasses in some areas. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62°F. The frost-free season is 300 to 350 days.

Typically, the surface layer is grayish brown clay loam 26 inches thick. The underlying material is weathered fractured sandstone or shale. The soil is slightly acid and mildly alkaline.

Anaheim soils are used for dryland pasture, range, field crops, and watershed.

Typical profile of Anaheim clay loam, 15 to 30 percent slopes, on the north side of a truck trail, about 300 feet east of a power pole and 3,000 feet north of Blue Mud Canyon, Chino Hills, Rancho Santa Ana, Orange County, NE¼NW¼ sec. 20 (projected), T. 3 S., R. 1 W., SBB&M.

A11—0 to 9 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; slightly acid; clear smooth boundary.

A12—9 to 17 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; neutral; clear wavy boundary.

A13—17 to 26 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine and fine tubular pores; mildly alkaline; abrupt wavy boundary.

Cr—26 to 54 inches; weathered fractured fine grained sandstone and shale coated with lime on the upper 6 inches of fractures.

The color of the A horizon ranges from brown to dark grayish brown in 10YR or 2.5Y hue. Texture is loam or clay loam. Thickness ranges from 20 to 36 inches. In places vertical cracks up to ¼ inch wide occur to a depth of 20 inches or more, but slickensides are absent.

The color of the Cr horizon ranges from light yellowish brown, light olive brown, very pale brown, light brownish gray to pale yellow in 10YR to 2.5Y hue. Depth to bedrock is 20 to 36 inches.

Reaction is neutral to moderately alkaline. The soil is calcareous in some parts.

106—Anaheim loam, 15 to 30 percent slopes. This moderately steep soil has a profile similar to the one described as typical of the series, but the texture is loam throughout.

About 7 percent of this mapping unit is included areas of Anaheim clay loam, 15 to 30 percent slopes; 5 percent Nacimiento clay loam, 15 to 30 percent slopes; 3 percent Cieneba sandy loam, 15 to 30 percent slopes; and 10 percent less sloping or steeper Anaheim soils.

If the soil is bare, runoff is rapid and the erosion hazard is high. Permeability is moderate. Available water capacity is 3.5 to 6.0 inches. The effective rooting depth is 24 to 36 inches.

Present land use is dryland pasture, range, and watershed. Capability unit IVe–1 (19); Loamy range site; Storie index 39.

107—Anaheim loam, 30 to 50 percent slopes. This steep soil commonly occurs on or near the top of broad rounded ridgetops. It has a profile similar to the one described as typical of the series, but the texture is loam.

About 7 percent of this mapping unit is included areas of Anaheim clay loam, 30 to 50 percent slopes; 4 percent Nacimiento clay loam, 30 to 50 percent slopes; 4 percent Cieneba sandy loam, 30 to 75 percent slopes; 10 percent less sloping or steeper Anaheim soils.

If the soil is bare, runoff is rapid and the erosion hazard is high. Permeability is moderate. Available water capacity is 3.5 to 6.0 inches. The effective rooting depth is 24 to 36 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit VIe–1 (19); Loamy range site; Storie index 21.

108—Anaheim clay loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on broad ridgetops and north-facing side slopes. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Alo clay; 5 percent Anaheim loam; 5 percent Nacimiento clay loam; 2 percent Cieneba sandy loam; and 3 percent Balcom clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Permeability is moderately slow. Available water capacity is 4.0 to 7.0 inches. The effective rooting depth is 24 to 40 inches.

Present land use is pasture and range. Capability unit IVe–1 (19); Clayey range site; Storie index 33.

109—Anaheim clay loam, 30 to 50 percent slopes. This steep soil generally has north-facing slopes.

About 5 percent of this mapping unit is included areas of Alo clay; 5 percent Anaheim loam; 5 percent Nacimiento clay loam; 2 percent Cieneba sandy loam; and 3 percent Calleguas clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Permeability is moderately slow. Available water capacity is 4.0 to 7.0 inches. The effective rooting depth is 24 to 36 inches.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 18.

110—Anaheim clay loam, 50 to 75 percent slopes. This very steep soil generally has north-facing slopes. It has a profile similar to the one described as typical

of the series, but it is 4 to 6 inches shallower over bedrock.

About 3 percent of this mapping unit is included areas of Cieneba sandy loam and 5 percent Calleguas clay loam.

If the soil is bare, runoff is very rapid and the erosion hazard is very high. Permeability is moderately slow. Available water capacity is 3.5 to 5.5 inches. The effective rooting depth is 20 to 30 inches.

Present land use is range and watershed. Capability unit VIIe–1 (19); Clayey range site; Storie index 8.

Balcom Series

The Balcom series consists of well drained soils on uplands. These soils formed in material weathered from soft fine grained sandstone, calcareous soft shale, and marl. Slopes are 9 to 50 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is annual grasses and forbs, mostly mustard, and some brush on the more eroded slopes. Precipitation is 14 to 20 inches, mean annual air temperature is 59 to 62° F., and the frost-free season is 300 to 350 days.

In a typical profile the upper 30 inches is grayish brown light clay loam. The underlying material is weathered fine grained sandstone and some calcareous shale coated with lime. It easily crushes to light gray, calcareous fine sandy loam in the upper 12 inches. Below this to a depth of 53 inches and more it is pale olive fractured soft bedrock.

The soil is moderately alkaline and calcareous throughout. It is moderately slowly permeable.

Balcom soils are used for dryland barley, dryland pasture, range, and urban development.

Typical profile of Balcom clay loam, 30 to 50 percent slopes, about 1,200 feet east of Oso Creek, Rancho Mission Viejo; SW¼NW¼, sec. 30, T. 6 S., R. 7 W., SBB&M.

A11—0 to 3 inches; grayish brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; violently effervescent; disseminated lime; moderately alkaline; clear smooth boundary.

A12—3 to 19 inches; grayish brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; violently effervescent; disseminated lime; moderately alkaline; clear wavy boundary.

A13ca—19 to 30 inches; grayish brown (10YR 5/2) light clay loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; violently effervescent; disseminated lime and lime coatings on some cobbles; moderately alkaline; abrupt wavy boundary.

Cr1—30 to 42 inches; light gray (10YR 7/1) weathered sandstone crushing to fine sandy loam, light brownish gray (10YR 6/2) moist; massive; hard, firm, slightly sticky and nonplastic; violently effervescent; some white slightly hard fine grained limestone; moderately alkaline; clear wavy boundary.

Cr2—42 to 53 inches; pale olive (5Y 6/3) fractured fine grained sandstone and calcareous shale; many lime coatings on rock fractures.

The A horizon ranges from light gray to light brownish gray, grayish brown, or pale brown in 2.5Y or 10YR hue. Texture is loam or clay loam. Small fragments of marl-like materials occur throughout the profile; the content is less than 15 percent. Structure ranges from granular to weak subangular blocky or the soil is massive. Dry consistence ranges from soft to slightly hard. The soil ranges from slightly calcareous to violently calcareous. Thickness ranges from 24 to 36 inches.

The C horizon ranges from white to light gray and gray to pale olive in 2.5Y, 5Y, or 10YR hue. Generally some of these colors are mixed. The bedrock is weathered lime coated sandstone, calcareous shale, or marl.

111—Balcom clay loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on hill ridgetops and some concave side slopes. The profile is similar to the one described as typical of the series, but it is 2 to 6 inches thicker.

About 5 percent of this mapping unit is included areas of Bosanko clay, 9 to 15 percent slopes; 4 percent Calleguas clay loam; 4 percent San Andreas sandy loam; and some soils, similar to this Balcom soil, that have a dark gray surface layer.

If the soil is bare, runoff is medium and the erosion hazard is high. Available water capacity is 4 to 6 inches. The effective rooting depth is 26 to 36 inches.

Present land use is urban development, dryland barley, and dryland pasture. Capability unit IIIe–1 (19); Clayey range site; Storie index 48.

112—Balcom clay loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on hill ridgetops. The profile is similar to the one described as typical of the series, but it is 2 to 6 inches thicker.

About 5 percent of this mapping unit is included areas of Bosanko clay, 15 to 30 percent slopes; 4 percent Calleguas clay loam; 4 percent Cieneba sandy loam, 15 to 30 percent slopes; and some soils, similar to the Balcom soil, that have a dark gray surface layer.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 4 to 6 inches. The effective rooting depth is 26 to 36 inches.

Present land use is urban development, dryland barley, and dry pasture. Capability unit IVe–1 (19); Clayey range site; Storie index 37.

113—Balcom clay loam, 30 to 50 percent slopes. This steep soil generally occurs as irregular and oblong areas of 40 to 100 acres. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Bosanko clay, 30 to 50 percent slopes; 4 percent Calleguas clay loam; 3 percent Cieneba sandy loam, 30 to 75 percent slopes; and some soils, similar

to the Balcom soil, that have a dark gray surface layer.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.5 to 5.0 inches. The effective rooting depth is 24 to 30 inches.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 18.

114—Balcom-Rock outcrop complex, 15 to 50 percent slopes. This moderately steep to steep mapping unit occurs as somewhat oblong areas of 5 to 100 acres. The Balcom soil has a profile similar to the one described as typical of the series, but the soil depth is about 4 inches less. Rock outcrop occupies 10 to 20 percent of the surface area.

About 5 percent of this mapping unit is included areas of Cieneba sandy loam and 10 percent Calleguas clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.5 to 5.0 inches. The effective rooting depth is 24 to 30 inches.

Present land use is range and watershed. Capability unit VIs–1 (19); Clayey range site; Storie index 18.

Beaches

115—Beaches consists of sandy, gravelly, or cobbly coastal shores that are washed and rewashed by tidal and wave action. These areas may be partly covered with water during high tides or stormy periods. They support little or no vegetation and have no agricultural value. Some are excellent recreational areas.

Runoff is very slow, and the erosion hazard is high.

Present land use is recreation and urban development. Capability unit VIIIw–1 (19); range site not assigned; Storie index less than 10 (nonagricultural).

Blasingame Series

The Blasingame series consists of well drained soils in the mountains. These soils formed in material weathered from metamorphic or granitic rocks. Slopes are 9 to 65 percent. Elevation ranges from 1,000 to 3,500 feet. The vegetation is chiefly brush; some areas have scattered oaks and annual grasses. Precipitation is 18 to 25 inches, and the mean annual air temperature is 58 to 61° F. The frost-free season is 225 to 300 days.

In a typical profile the surface layer is brown loam 6 inches thick. The subsoil is yellowish red clay loam about 20 inches thick. The substratum to a depth of 50 inches is reddish yellow weathered andesite bedrock. It grades to unweathered rock within several feet.

The soil is slightly acid in the surface layer and medium acid in the subsoil. It is moderately slowly permeable.

Blasingame soils are used for range, watershed, and wildlife.

Typical profile of Blasingame loam, 9 to 30 percent slopes, in Orange County, along Santiago Truck Trail about ½ mile east of Morrow Trail, NW¼SW¼ sec. 35, T. 5 S., R. 7 W.

A11—0 to 1 inch; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine, fine, and few medium and coarse tubular pores; slightly acid; abrupt smooth boundary.

A12—1 to 6 inches; brown (7.5YR 4/4) loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, medium and coarse roots; common very fine and medium tubular pores; slightly acid; clear wavy boundary.

B1—6 to 8 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, medium and common coarse roots; common very fine, fine, and medium tubular pores; common thin clay films as bridges and lining pores; slightly acid; abrupt wavy boundary.

B21t—8 to 17 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/8) moist; strong medium and coarse angular blocky structure; very hard, firm, very sticky and very plastic; few very fine, fine, medium and coarse roots; few very fine and fine tubular pores; many moderately thick clay films on peds; medium acid; gradual wavy boundary.

B22t—17 to 26 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/8) moist; moderate medium and coarse angular and subangular blocky structure; very hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; few very fine and fine tubular pores; many moderately thick clay films on peds; medium acid; abrupt wavy boundary.

Cr—26 to 50 inches; yellow, reddish yellow, red, and black weathered metamorphic rock; crushes easily; few clay film coatings on upper fractures.

The A horizon ranges from reddish brown to brown and yellowish brown in 10YR, 7.5YR, and 5YR hue. Texture is sandy loam or loam, with or without stones. Structure ranges from granular to subangular blocky. In places the soil is massive. Dry consistence ranges from slightly hard to hard. Reaction ranges from neutral to slightly acid. Thickness ranges from 3 to 11 inches.

The B1 horizon is 0 to 4 inches thick. The B2t horizon ranges from reddish brown to brown and yellowish red in 7.5YR and 5YR hue. Texture is sandy clay loam or clay loam with or without stones. Structure ranges from fine to coarse. Dry consistence ranges from hard to very hard. Thickness ranges from 17 to 21 inches.

The Cr horizon is weathered andesite, weathered metamorphic rock, or decomposed granitic rock.

116—Blasingame loam, 9 to 30 percent slopes. This strongly sloping to moderately steep soil generally occurs on the gentler, somewhat rolling lower mountain

ridgetops. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Blasingame stony loam, 9 to 30 percent slopes; 5 percent Las Posas gravelly loam, 15 to 50 percent slopes; 5 percent Vista coarse sandy loam; and 5 percent Ramona fine sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate to high. Available water capacity is 3.5 to 6.5 inches. The effective rooting depth is 24 to 36 inches.

Present land use is range, watershed, and wildlife. Capability unit IVe–1 (19); Loamy range site; Storie index 39.

117—Blasingame stony loam, 9 to 30 percent slopes. This strongly sloping to moderately steep soil generally occurs on the gentler, lower mountain ridgetops. The profile is similar to the one described as typical of the series, but it is stony throughout.

About 5 percent of this mapping unit is included areas of Blasingame loam, 9 to 30 percent slopes; 5 percent Las Posas gravelly loam, 15 to 50 percent slopes; and 5 percent Friant fine sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate to high. Available water capacity is 3.0 to 5.0 inches. The effective rooting depth is 24 to 32 inches.

Present land use is range, watershed, and wildlife. Capability unit VIs–1 (19); Loamy range site; Storie index 27.

118—Blasingame stony loam, 30 to 65 percent slopes. This steep to very steep soil generally occurs on lower mountainsides. The profile is similar to the one described as typical of the series, but it is stony throughout and is slightly shallower.

About 5 percent of this mapping unit is included areas of Exchequer-Rock outcrop complex and 5 percent Friant fine sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate to high. Available water capacity is 2.5 to 4.5 inches. The effective rooting depth is 20 to 32 inches.

Present land use is range, watershed, and wildlife. Capability unit VIIs–1 (19); Loamy range site; Storie index 11.

119—Blasingame-Rock outcrop complex, 9 to 30 percent slopes. This rolling complex occurs on lower mountain ridgetops. The Blasingame soil has a profile similar to the one described as typical of the series, but it is slightly shallower. About 20 to 35 percent of the surface is large granitic boulders or Rock outcrop, or both.

About 10 percent of this complex is included areas of Vista-Rock outcrop complex; 5 percent Cieneba-Rock outcrop, 9 to 30 percent slopes; and 10 percent less sloping or steeper Blasingame-Rock outcrop.

If the soil is bare, runoff is medium to rapid and the erosion hazard is high. Available water capacity is 3.0 to 5.0 inches. The effective rooting depth is 24 to 32 inches.

Present land use is range and watershed. Capability unit for VIs–1 (19); Loamy-Rock outcrop complex range site; Storie index 20.

120—Blasingame-Vista complex, 9 to 15 percent slopes. This strongly sloping mapping unit is about 50 percent Blasingame loam, 9 to 15 percent slopes, and 40 percent Vista coarse sandy loam, 9 to 15 percent slopes. The Blasingame loam is on north- and east-facing slopes and in swales. Vista coarse sandy loam is on ridgetops and south- and west-facing slopes.

About 6 percent of this complex is included areas of Cieneba sandy loam, 4 percent Las Posas gravelly loam, and 5 percent less sloping or steeper soils.

Both soils have the profiles described as typical of the respective series. The Blasingame soil has an effective rooting depth of 24 to 36 inches and an available water capacity of 3.5 to 6.5 inches. The Vista soil has an effective rooting depth of 30 to 40 inches and an available water capacity of 3.0 to 5.0 inches. Runoff is medium on both soils, and the erosion hazard is moderate to high.

This unit is used for range and watershed. Capability unit IVe–1 (19); Loamy range site; Storie index 51 (according to the proportion of dominant soils).

121—Blasingame-Vista complex, 15 to 30 percent slopes. This moderately steep mapping unit is about 50 percent Blasingame loam and 40 percent Vista coarse sandy loam. The Blasingame loam is on north- and east-facing side slopes and in swales. The Vista coarse sandy loam is on ridgetops and south- and west-facing side slopes.

About 5 percent of this mapping unit is included areas of Cieneba sandy loam, about 5 percent Las Posas gravelly loam, and 10 percent less sloping or steeper soils.

Both soils have the profiles described as typical of the respective series. The Blasingame soil has an effective rooting depth of 24 to 32 inches and an available water capacity of 3.5 to 6.0 inches. The Vista soil has an effective rooting depth of 24 to 40 inches and an available water capacity of 2.5 to 5.0 inches. On both soils, runoff is medium and the erosion hazard is moderate to high.

Present land use is range and watershed. Capability unit VIe–1 (19); Loamy range site; Storie index 36 (according to the proportion of dominant soils).

Bolsa Series

The Bolsa series consists of somewhat poorly drained soils on alluvial fans. These soils formed in mixed alluvium. Slopes are 0 to 2 percent. Elevation ranges from 5 to 300 feet. The vegetation is annual grasses and forbs. Precipitation is 12 to 15 inches, and the mean annual air temperature is about 62° F. The frost-free season is 300 to 350 days.

Typically, the surface layer is light brownish gray silt loam 12 inches thick. The upper 17 inches of underlying material is light brownish gray silt loam with some very faint mottles. It is light brownish gray silty clay loam with common reddish yellow mottles to a depth of 65 inches or more.

The soil is moderately alkaline throughout and calcareous to a depth of 49 inches. It is moderately slowly permeable.

Bolsa soils are used for row crops, field crops, and urban development.

Typical profile of Bolsa silt loam, in Huntington Beach, SE¼SE¼ sec. 12, T. 6 S., R. 7 W. Orange

County, northwest corner of Magnolia and Atlanta Avenues:

Ap1—0 to 6 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—6 to 12 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and common medium roots; common very fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—12 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few very faint mottles; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and common medium roots; common very fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—18 to 29 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and common medium roots; common very fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C3—29 to 39 inches; light brownish gray (10YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) moist; few fine prominent reddish yellow (7.5YR 6/6) mottles, strong brown (7.5YR 5/6) moist; weak fine and medium prismatic structure; very hard, firm, sticky and plastic; few fine and common medium roots; common very fine tubular pores; salts in fine threads; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—39 to 49 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine prominent reddish yellow (7.5YR 6/6) mottles, strong brown (7.5YR 5/6) moist; weak fine and medium prismatic structure; very hard, firm, sticky and plastic; few fine roots; common very fine and fine tubular pores; salts in fine threads; strongly effervescent; moderately alkaline; clear smooth boundary.

C5—49 to 55 inches; light brownish gray (2.5Y 6/2) and dark gray (2.5Y 4/0) heavy silty clay loam, high in organic matter; dark grayish brown (2.5Y 4/2) and dark gray (2.5Y 4/0) moist; common fine prominent reddish yellow (7.5Y 6/6) mottles, strong brown (7.5Y 5/6) moist; weak coarse prismatic structure; very hard, very firm, very sticky and plastic; few fine and medium roots; many very fine and fine tubular pores; moderately alkaline; clear smooth boundary.

C6—55 to 69 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; many fine prominent brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; massive, with thin strata; hard, firm, sticky and plastic; common very fine pores; salts in fine threads; moderately alkaline.

The A horizon ranges from light brownish gray to grayish brown in 10YR hue. Texture ranges from sandy loam, silt loam, and loam to silty clay loam. Thickness ranges from 10 to 20 inches.

The C horizon ranges from light gray, light brownish gray, pale brown, and grayish brown to dark gray in 10YR and 2.5Y hue. Texture, which is variable because of stratification, ranges from loamy sand to heavy silty clay loam.

The soils are calcareous to a depth of 40 inches or more. Natural drainage is somewhat poor. Many areas, however, are now drained and the water table is below 60 inches.

122—Bolsa silt loam. This nearly level soil generally occurs on large alluvial fans.

About 10 percent of this mapping unit is included areas of Chino silty clay loam; 10 percent Hueneme fine sandy loam; 2 percent Omni silt loam, drained; 3 percent Tidal flats; and 10 percent soils that have a sandy loam overwash but are otherwise similar to this Bolsa soil.

Runoff is very slow, and the erosion hazard is slight. A seasonal water table is at a depth of 36 to 72 inches. Available water capacity is 11.5 to 12.5 inches. The effective rooting depth is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit IIw–2 (19); range site not assigned; Storie index 76.

123—Bolsa silt loam, drained. This nearly level soil generally occurs on large alluvial fans. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Chino silty clay; 10 percent Hueneme fine sandy loam; 2 percent Metz loamy sand; 2 percent San Emigdio fine sandy loam; 1 percent Omni silt loam, drained; and 2 percent soils that have a sandy loam overwash but are otherwise similar to this Bolsa soil.

If the soil is bare, runoff is slow and the erosion hazard is slight. The effective rooting depth is 60 inches or more. The available water capacity is 11.5 to 12.5 inches.

Present land use is row crops, field crops, and urban development. Capability unit I (19); range site not assigned; Storie index 85.

124—Bolsa silty clay loam. This nearly level soil generally occurs on large alluvial fans. The profile is similar to the one described as typical of the series, but the texture is silty clay loam.

About 5 percent of this mapping unit is included

areas of Omni clay and 5 percent Chino silty clay loam.

Runoff is very slow, and the erosion hazard is none to slight. The water table is at a depth of 36 to 72 inches. Available water capacity is 11.5 to 12.5 inches. The effective rooting depth is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit IIw–2 (19); range site not assigned; Storie index 68.

125—Bolsa silty clay loam, drained. This nearly level soil generally occurs on large alluvial fans. The profile is similar to the one described as typical of the series, but the texture is silty clay loam.

About 10 percent of this mapping unit is included areas of Chino silty clay loam, 3 percent Hueneme fine sandy loam, and 3 percent Omni clay.

Runoff is slow, and the erosion hazard is slight. Available water capacity is 11.5 to 12.5 inches. The effective rooting depth is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit I (19); range site not assigned; Storie index 77.

Bosanko Series

The Bosanko series consists of well drained soils on foothills. These soils formed in material weathered from calcareous shale, sandstone, or weakly consolidated sediments. Slopes are 9 to 50 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is annual grasses, mustard, and other forbs. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 61° F. The frost-free season is 300 to 350 days.

Figure 1.—Profile of Bosanko clay, 9 to 15 percent slopes.

Typically, the surface layer is dark gray clay 25 inches thick. The next layer is calcareous mixed dark gray clay and pale yellow weathered shale 12 inches thick. The bedrock is pale yellow and light brownish gray weathered shale (fig. 1).

The soil is mildly alkaline in the upper 12 inches and moderately alkaline below. It is slowly permeable.

Bosanko soils are used for dryland small grain, pasture, range, citrus, and urban development.

Typical profile of Bosanko clay, 9 to 15 percent slopes, NW¼SE¼ sec. 20, T. 6 S., R. 7 W., SBB&M; east of Oso Creek and about 1,600 feet southwest of Triangulation Point 1128:

Ap—0 to 2 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; strong fine and medium granular structure; very hard, firm, very sticky and very plastic; common very fine roots; many fine and medium interstitial pores; mildly alkaline; abrupt smooth boundary.

A12—2 to 12 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; strong very coarse prismatic structure; extremely hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; mildly alkaline; gradual smooth boundary.

A13—12 to 25 inches; dark gray (10YR 4/1) clay, black (10YR 2/1) moist; moderate very coarse prismatic structure; extremely hard, firm, very sticky and very plastic; few very fine roots; many very fine tubular pores; common fine and medium intersecting slickensides; moderately alkaline; gradual wavy boundary.

ACca—25 to 37 inches; dark gray (10YR 4/1) clay and pale yellow (5Y 7/3) weathered shale, black (10YR 2/1) and olive (5Y 5/3) moist; moderate very coarse prismatic structure; very hard, firm, very sticky and very plastic; strongly effervescent; fine lime filaments and soft masses; moderately alkaline; clear smooth boundary.

Cr1—37 to 47 inches; pale yellow (5Y 7/3) weathered shale, olive (5Y 5/3) moist; very few very fine roots on fractures; lime coatings along fractures; common vertical and horizontal deposits of gypsum ¼ to 1 inch wide; moderately alkaline; gradual irregular boundary.

Cr2—47 to 79 inches; light brownish gray (2.5Y 6/2) weathered shale, grayish brown (2.5Y 5/2) moist; lime coatings along fractures; common vertical and horizontal deposits of gypsum ¼ to 1 inch wide; moderately alkaline.

The A horizon ranges from dark gray to gray in

10YR hue. Texture is clay, silty clay, or heavy clay loam. Structure ranges from granular in the upper few inches to prismatic or angular blocky. Dry consistence ranges from hard to extremely hard. Reaction is slightly acid to mildly alkaline in the A11 and A12 horizons and mildly alkaline to moderately alkaline in the A13. The A horizon is usually noncalcareous throughout. Thickness ranges from 14 to 25 inches.

The ACca horizon is generally two separate colors with about equal proportions of A and Cr materials. Texture is about the same as in the A horizon. In places the ACca contains segregated lime and is calcareous. Thickness ranges from 8 to 13 inches.

The Cr horizon is weathered shale or sandstone, or both, that can be easily cut with hand tools. Colors range from pale yellow, light brownish gray, and light gray to white in 5Y or 2.5Y hue. Lime coatings or some type of segregated lime generally occurs in the upper Cr horizon. Intersecting slickensides occur in the lower A horizon and in places in the ACca horizon.

When dry, the soil has cracks more than ½ inch wide to a depth of 20 inches to 36 inches.

126—Bosanko clay, 9 to 15 percent slopes. This strongly sloping soil generally occurs on broad hilltop ridges and on toe slopes. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Balcom clay loam, 9 to 15 percent slopes; 4 percent Alo clay, 9 to 15 percent slopes; and 10 percent soils that are similar to this Bosanko soil and are more than 40 inches deep.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 3.5 to 6.5 inches. The effective rooting depth is 26 to 38 inches.

Present land use is citrus, dryland barley, pasture, range, and urban development. Capability unit IIIe–5 (19); Clayey range site; Storie index 28.

127—Bosanko clay, 15 to 30 percent slopes. This moderately steep soil occurs on broad hilltop ridges. The profile is similar to the one described as typical of the series, but it is slightly shallower.

About 7 percent of this mapping unit is included areas of Balcom clay loam, 15 to 30 percent slopes; and 5 percent Alo clay, 15 to 30 percent slopes.

If the soil is bare, runoff is rapid and the erosion hazard is moderate. Available water capacity is 3.5 to 6.0 inches. The effective rooting depth is 26 to 36 inches.

Present land use is dryland barley, pasture, range, and urban development. Capability unit IVe–5 (19); Clayey range site; Storie index 21.

128—Bosanko clay, 30 to 50 percent slopes. This steep soil generally occurs on north-facing hillsides. The profile is similar to the one described as typical of the series, but it is slightly shallower.

About 7 percent of this mapping unit is included areas of Balcom clay loam, 30 to 50 percent slopes; and 5 percent Alo clay, 30 to 50 percent slopes.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 3.0 to 5.5 inches. The effective rooting depth is 22 to 32 inches.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 11.

129—Bosanko-Balcom complex, 15 to 30 percent slopes. This moderately steep mapping unit is about 45 percent Bosanko clay and about 45 percent Balcom clay loam. The Bosanko clay is on north- and east-facing side slopes and in swales. The Balcom clay loam is on hill ridgetops and on south- and west-facing side slopes.

About 3 percent of this unit is included areas of Alo clay, 15 to 30 percent slopes; 2 percent San Andreas sandy loam, 15 to 30 percent slopes; 5 percent Calleguas clay loam; and 10 percent less sloping or steeper soils.

Both soils have the profiles described as typical of the respective series. The Bosanko clay has an effective rooting depth of 26 to 36 inches and an available water capacity of 3.5 to 6.0 inches. The Balcom clay loam has an effective rooting depth of 26 to 36 inches and an available water capacity of 4.0 to 6.0 inches. Runoff is rapid, and the erosion hazard is moderate to high.

Present land use is dryland barley, pasture, and range. Capability unit IVe–5 (19); Clayey range site; Storie index 29 (according to the proportion of dominant soils).

130—Bosanko-Balcom complex, 30 to 50 percent slopes. This steep mapping unit is about 45 percent Bosanko clay and about 40 percent Balcom clay loam. The Bosanko clay is on north- and east-facing side slopes and in swales. The Balcom clay loam is on hill ridgetops and on south- and west-facing side slopes.

About 5 percent of this complex is included areas of Alo clay, 30 to 50 percent slopes; 3 percent Cieneba sandy loam; 7 percent Callaguas clay loam; and 10 percent less sloping or steeper soils.

Both soils have the profiles described as typical of the respective series. The Bosanko clay has an effective rooting depth of 22 to 32 inches and an available water capacity of 3.5 to 5.0 inches. The Balcom clay loam has an effective rooting depth of 24 to 30 inches and an available water capacity of 3.5 to 5.0 inches. Runoff is rapid, and the erosion hazard is high.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 13 (according to the proportion of dominant soils).

Botella Series

The Botella series consists of well drained soils on alluvial fans. These soils formed in sedimentary alluvium. Slopes are 2 to 15 percent. Elevation ranges from 25 to 1,500 feet. The vegetation is mainly annual grasses and forbs and some oak trees and brush. Precipitation is 12 to 20 inches, and the average annual air temperature is about 62° F. The frost-free season is 260 to 350 days.

Typically, the surface layer is grayish brown, slightly acid clay loam 8 inches thick. The subsoil is gray, neutral to mildly alkaline silty clay loam 27 inches thick. The substratum is gray and grayish brown, mildly alkaline or moderately alkaline clay loam to a depth of 66 inches or more.

The soil is moderately slowly permeable. Available water capacity is 9.5 to 11.5 inches. The effective rooting depth is 60 inches or more.

Botella soils are used for irrigated citrus, dryland small grain, pasture, and range.

Typical profile of Botella clay loam, 2 to 9 percent

slopes, in NW¼NE¼ sec. 6, T. 6 S., R. 7 W., SBB&M., Orange County, about 2 miles northeast of Highway 101 and ½ mile east of Oso Creek, in a small valley, on a 4 percent slope:

A1—0 to 8 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium subangular blocky structure; hard, friable, very sticky and plastic; many very fine roots; common very fine tubular pores; slightly acid; clear smooth boundary.

B21t—8 to 24 inches; gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; common very fine tubular pores; continuous thin clay films on peds; neutral; clear smooth boundary.

B22t—24 to 35 inches; gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; many very fine tubular pores; continuous thin clay films on peds; mildly alkaline; slightly wavy boundary.

C1—35 to 50 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; mildly alkaline; gradual wavy boundary.

C2—50 to 63 inches; gray (10YR 5/1) clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, sticky and plastic; common very fine roots; many very fine tubular pores; moderately alkaline; gradual smooth boundary.

C3—63 to 66 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, sticky and plastic; few very fine roots; many very fine tubular pores; moderately alkaline.

The A horizon ranges from grayish brown to dark grayish brown and gray to dark gray in 10YR hue. Texture is very fine sandy loam, loam, sandy clay loam, or clay loam. Structure varies from granular to subangular blocky. Dry consistence ranges from slightly hard to hard. Reaction ranges from slightly acid to neutral. Thickness ranges from 5 to 18 inches.

The B2t horizon ranges from gray to dark gray and grayish brown to dark grayish brown in 10YR and 2.5Y hue. Texture is sandy clay loam, clay loam, or silty clay loam. Structure is prismatic or subangular blocky. Dry consistence is hard or very hard. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 11 to 30 inches.

The C horizon is sandy loam, fine sandy loam, sandy clay loam, or clay loam.

The Botella soils in this area have chroma somewhat higher in the mollic epipedon than is typical of the series as recognized elsewhere in California.

131—Botella loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on alluvial fans in long, narrow foothill valleys. It has a profile similar to the one described as typical of the series, but the surface layer is loam.

About 5 percent of this mapping unit is included areas where slopes at the lower ends of fans or valleys are 0 to 2 percent; 5 percent Capistrano sandy loam, 2 to 9 percent slopes; 5 percent Botella clay loam, 2 to 9 percent slopes; and 3 percent Sorrento sandy loam, 2 to 9 percent slopes.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is irrigated citrus, dryland small grain, pasture, and range. Capability unit IIe–1 (19); Loamy range site; Storie index 85.

132—Botella clay loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on alluvial fans in narrow foothill valleys. This soil has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas where slopes at the lower ends of fans or valleys are 0 to 2 percent; 5 percent Botella loam, 2 to 9 percent slopes; 5 percent Sorrento clay loam; and 3 percent Mocho loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is irrigated citrus, dryland small grain, pasture, and range. Capability unit IIe–1 (19); Clayey range site; Storie index 73.

133—Botella clay loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on alluvial fans in narrow foothill valleys.

About 3 percent of this mapping unit is included areas where slopes at the upper ends of fans or valleys are generally more than 15 percent; 5 percent Botella loam, 9 to 15 percent slopes; 3 percent Sorrento clay loam; and 3 percent Mocho loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is irrigated citrus, dryland small grain, pasture, and range. Capability unit IIIe–1 (19); Clayey range site; Storie index 69.

Calleguas Series

The Calleguas series consists of well drained soils on uplands. These soils formed in material weathered from lime coated shale or lime coated sandstone, or both. Slopes are 50 to 75 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is annual grasses and forbs, mostly mustard and brush. Precipitation is 13 to 20 inches, and the mean annual air temperature is about 61° F. The frost-free season is 300 to 350 days.

Typically, the soil is pale brown clay loam and shaly clay loam 15 inches thick. The underlying material is soft fractured shale with lime coatings. The soil is moderately alkaline and calcareous throughout. It is about 10 percent angular shale fragments to a depth of 11 inches and about 35 percent angular shale fragments from a depth of 11 to 15 inches.

The soil is moderately permeable. Available water

capacity is 1.5 to 3.5 inches. The effective rooting depth is 10 to 19 inches.

Calleguas soils are used for range, watershed, wildlife, and urban development.

Typical profile of Calleguas clay loam, 50 to 75 percent slopes, in Orange County, Irvine Ranch, along Buck Gully about ¼ mile northeast of Pacific Coast Highway, Corona Del Mar, NE¼SW¼ sec. 96 (by a private survey), T. 7 S., R. 9 W., SBB&M.

A11—0 to 7 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; many very fine and fine tubular pores; about 10 percent angular shale fragments; strongly effervescent; disseminated lime; moderately alkaline; clear wavy boundary.

A12—7 to 11 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; slightly hard, very friable, sticky and slightly plastic; many very fine roots; common very fine pores; about 10 percent angular shale fragments; violently effervescent; disseminated lime; moderately alkaline; abrupt wavy boundary.

A13—11 to 15 inches; pale brown (10YR 6/3) shaly clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable, sticky and plastic; many very fine roots; many very fine and few fine pores; about 35 percent angular shale fragments; violently effervescent; disseminated lime; moderately alkaline; abrupt wavy boundary.

Cr—15 to 42 inches; soft fractured shale with lime coatings on fractures.

The A horizon ranges from light brownish gray to pale brown and grayish brown in 10YR and 2.5Y hue. Texture is loam or clay loam. About 5 to 35 of the soil volume is small rock fragments. Structure is granular, or the soil is massive. Dry consistence is soft or slightly hard. Reaction is moderately alkaline. Carbonates are strongly effervescent to violently effervescent. Thickness ranges from 10 to 19 inches.

The Cr horizon is lime coated sandstone or calcareous shale, or both. It ranges from highly weathered to hard rock, but most of the material can be easily crushed.

134—Calleguas clay loam, 50 to 75 percent slopes, eroded. This very steep soil generally has south-facing slopes. It has the profile described as typical of the series. As much as 75 percent of the original surface layer has been lost in areas that have been cultivated, overgrazed, or burned because of sheet, rill, and gully erosion. Geologic erosion is active, and soil slipping is common. Many areas are a succession of short, vertical exposures or "cat steps."

About 5 percent of this mapping unit is included areas of Cieneba sandy loam; 5 percent Balcom clay loam; 3 percent Anaheim clay loam; and 10 percent less sloping or steeper Calleguas clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range, watershed, and urban development. Capability unit VIIe–1 (19); Shallow Clayey range site; Storie index 4.

Capistrano Series

The Capistrano series consists of well drained soils. These soils formed in granitic alluvium on alluvial fans and alluvial plains in small valleys of the Santa Ana Mountains and in sedimentary alluvium of the coastal foothills. Slopes are 2 to 15 percent. Elevation ranges from 25 to 2,500 feet. The vegetation is mostly grasses. There are a few oak trees in some areas. Precipitation is 14 to 25 inches, and the mean annual air temperature is about 60°F. The frost-free season is 240 to 340 days.

Typically, the surface layer is dark grayish brown sandy loam 27 inches thick. The underlying material is grayish brown sandy loam to a depth of 65 inches or more.

The soil is medium acid throughout. It is moderately rapidly permeable. The effective rooting depth is 60 inches or more. Available water capacity is 5.5 to 7.5 inches.

Capistrano soils are used for citrus, barley, pasture, range, wildlife, and recreation.

Typical profile of Capistrano sandy loam, 9 to 15 percent slopes, in Orange County, El Toro area, about 4,600 feet north-northeast of Trabuco Road and 200 feet northwest of Canada Road, Rancho Los Alisos; T. 5 S., R. 8 W., SBB&M.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; interstitial pores, medium acid; abrupt smooth boundary.

A12—5 to 16 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few very fine tubular pores; common very fine interstitial pores; medium acid; gradual smooth boundary.

A13—16 to 27 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; few very fine tubular pores; common very fine interstitial pores; medium acid; gradual smooth boundary.

C—27 to 65 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; few very fine interstitial pores; medium acid.

The A horizon ranges from dark brown and brown to dark grayish brown in 10YR hue. Texture is fine sandy loam, sandy loam, or coarse sandy loam and may be gravelly. Structure is weak granular or subangular blocky, or the soil is massive. Thickness ranges from 20 to 40 inches. Reaction ranges from medium acid to neutral.

The C horizon ranges from brown and light yellowish brown to brownish yellow or grayish brown in 10YR hue and in places is mottled. Texture is sandy loam, coarse sandy loam, or fine sandy loam and may be gravelly. Reaction ranges from medium acid to mildly alkaline.

135—Capistrano sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil occurs mostly as long, narrow areas in small valleys.

About 7 percent of this mapping unit is included areas of a Capistrano soil that is gravelly; 2 percent Ramona fine sandy loam; 5 percent Hanford sandy loam; 5 percent Corralitos loamy sand; and 2 percent Myford sandy loam.

If the soil is bare, runoff is slow to medium and the erosion hazard is moderate.

Present land use is citrus, barley, pasture, range, wildlife, and recreation. Capability unit IIIe–1 (19); Loamy range site; Storie index 90.

136—Capistrano sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on small toe slope fans and in small, narrow foothill valleys. It has the profile described as typical of the series.

About 3 percent of this mapping unit is included areas of Capistrano soils where slopes at the upper ends of fans or valleys are generally more than 15 percent; 5 percent soils that have a sandy clay loam subsoil; 5 percent San Andreas sandy loam; and 3 percent Myford sandy loam, 9 to 15 percent slopes.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is irrigated citrus, dryland barley, pasture, and range. Capability unit IVe–1 (19); Loamy range site; Storie index 81.

Chesterton Series

The Chesterton series consists of moderately well drained soils. These soils formed in terracelike cappings over upland ridges. Slopes are 2 to 30 percent. Elevation ranges from 200 to 900 feet. The vegetation is annual grasses and forbs or native brush. Precipitation is 12 to 14 inches, and the mean annual air temperature is about 61°F. The frost-free season is 300 to 350 days.

Typically, the surface layer is pale brown loamy sand 15 inches thick. The subsurface layer is white leached loamy sand 1 inch thick. The subsoil is brown or grayish brown sandy clay, mottled with brownish yellow and yellowish red, 14 inches thick. The substratum is 2 inches of yellowish brown sandy loam that overlies a silica cemented hardpan.

The soil is strongly acid throughout. It is very slowly permeable. Available water capacity is 1.0 to 2.5 inches. The effective rooting depth is 20 to 40 inches.

Chesterton soils are used for range, watershed, and urban development.

Typical profile of Chesterton loamy sand, 2 to 15 percent slopes, about ½ mile north-northeast of the intersection of Vista Del Sol Road and Coast Highway 1, South Laguna, T. 8 S., R. 8 W., SBB&M.

A11—0 to 5 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and medium roots; many fine interstitial pores; very few fine tubular pores; strongly acid; gradual smooth boundary.

A12—5 to 12 inches; pale brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine, few fine and medium roots; many fine interstitial pores; strongly acid; gradual smooth boundary.

A13—12 to 15 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; many fine interstitial pores; strongly acid; abrupt wavy boundary.

A2—15 to 16 inches; white (10YR 8/2) loamy sand, pale brown (10YR 6/3) moist; massive; hard, friable, slightly sticky and nonplastic; very few very fine roots; many fine interstitial pores; strongly acid; abrupt smooth boundary.

B21t—16 to 22 inches; brown (10YR 5/3) sandy clay with 30 percent brownish yellow (10YR 6/6) and 20 percent yellowish red (5YR 4/8) mottles, grayish brown (10YR 5/2) with yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) mottles moist; strong coarse prismatic structure; extremely hard, firm, sticky and plastic; very few very fine exped roots; few fine interstitial pores; very few fine tubular pores; many moderately thick and thick clay films on peds and as bridges; strongly acid; gradual wavy boundary.

B22t—22 to 30 inches; grayish brown (10YR 5/2) sandy clay with 20 percent brownish yellow (10YR 6/6) and 10 percent yellowish red (5YR 4/8) mottles, dark grayish brown (10YR 4/2) with yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) mottles moist; moderate coarse prismatic structure; extremely hard, firm, sticky and plastic; very few very fine exped roots; continuous thick clay films line few fine and large root channels; strongly acid; clear smooth boundary.

C1—30 to 32 inches; yellowish brown (10YR 5/6) coarse sandy loam, brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky, nonplastic; continuous thick clay films line few root channels and few fractures; strongly acid; abrupt smooth boundary.

C2m—32 inches; silica cemented hardpan; common medium and coarse horizontal roots along the upper boundary; very difficult to cut with hand tools.

The A1 horizon ranges from brown to very pale brown in 10YR hue. Texture is loamy sand or sandy loam. Dry consistence ranges from soft to hard. Reaction is strongly acid to medium acid. Thickness ranges from 10 to 19 inches. Some profiles lack the thin A2 horizon. There are no iron concretions in the A horizon. A few ⅛ to ½ inch in size occur at the surface in this area.

The B2t horizon is brown, grayish brown, or yellowish brown in 10YR or 7.5YR hue. In places it is mottled with brownish yellow, yellowish red, gray, or red. Texture is heavy clay loam or sandy clay. In places the prismatic structure parts to angular blocky. Reaction is strongly acid to medium acid. Thickness ranges from 10 to 18 inches.

The thin C1 horizon is discontinuous. Depth to the white to reddish brown Cm horizon is 20 to 37 inches.

The Chesterton soils in this area do not have the concretions typical of the series as recognized elsewhere in California.

137—Chesterton loamy sand, 2 to 15 percent slopes. This gently sloping to strongly sloping soil is generally on undulating terracelike cappings of hills within a few miles of the coast. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Chesterton soils, 0 to 2 percent slopes; 5 percent Marina loamy sand; 5 percent Myford sandy loam; and 5 percent soils that are 10 to 20 inches deep over a silica hardpan and do not have a sandy clay subsoil but are otherwise similar to this Chesterton soil.

If the soil is bare, runoff is medium and the erosion hazard is high.

Present land use is range, watershed, and urban development. Capability unit VIe–1 (19) ; Claypan range site; Storie index 21.

138—Chesterton loamy sand, 15 to 30 percent slopes. This moderately steep soil generally occurs at the edges of terracelike cappings on hills within a few miles of the coast.

About 10 percent of this mapping unit is included areas of less sloping or steeper soils; 4 percent Marina loamy sand; 4 percent Myford sandy loam; and 5 percent soils that are 10 to 20 inches deep over a silica hardpan and do not have a sandy clay subsoil but are otherwise similar to this Chesterton soil.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range, watershed, and some urban development. Capability unit VIe–1 (19); Claypan range site; Storie index 15.

Chino Series

The Chino series consists of somewhat poorly drained soils on alluvial fans. These soils formed in sedimentary alluvium. Slopes are 0 to 2 percent. Elevation ranges from 5 to 200 feet. The vegetation is annual grasses and forbs. Precipitation is 12 to 15 inches, and the mean annual air temperature is about 61° F. The frost-free season is 300 to 350 days.

Typically, the surface layer is gray silty clay loam 24 inches thick. The underlying material is grayish brown, gray, and light gray silty clay loam in places mottled with light brownish gray. It is 23 inches thick over light gray sandy clay loam, which extends to a depth of 60 inches or more.

The soil is moderately alkaline and calcareous throughout. It is moderately slowly permeable. Available water capacity is 9.5 to 13.0 inches.

Chino soils are used for row crops, field crops, and urban development.

Typical profile of Chino silty clay loam, on the Irvine Ranch, N¼S¼ sec. 45 (by private survey), in Orange County:

Ap1—0 to 3 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, sticky and plastic; common very fine roots; common very fine and fine tubular pores; violently effervescent; disseminated lime throughout; moderately alkaline; abrupt smooth boundary.

Ap2—3 to 13 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium angular and subangular blocky structure; hard, friable, sticky and plastic; very few fine and common very fine roots; common very fine and fine tubular pores; violently effervescent; disseminated lime throughout; moderately alkaline; abrupt smooth boundary.

A13—13 to 24 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist, with light brownish gray (2.5Y 6/2) mottles, dark grayish brown (2.5Y 4/2) moist; weak medium angular and subangular blocky structure; hard, friable, sticky and plastic; very few fine and common very fine roots; very few medium and common very fine and fine tubular pores; violently effervescent; disseminated lime throughout; moderately alkaline; clear smooth boundary.

C1—24 to 29 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist, with light brownish gray (2.5Y 6/2) mottles, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; common very fine roots; few fine and common very fine tubular pores; violently effervescent; disseminated and medium sized filaments of lime throughout; moderately alkaline; clear smooth boundary.

C2—29 to 37 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable, sticky and plastic; few very fine roots; common very fine and fine tubular pores; violently effervescent; disseminated lime throughout; moderately alkaline; abrupt smooth boundary.

C3—37 to 47 inches; light gray (10YR 7/1) silty clay loam, gray (10YR 5/1) moist; massive; hard, firm, sticky and plastic; very few very fine roots; common very fine tubular pores; violently effervescent; disseminated lime throughout; moderately alkaline; clear smooth boundary.

C4—47 to 60 inches; light gray (10YR 6/1 and 2.5Y 7/2) sandy clay loam, dark gray (10YR 4/1) and dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, sticky and plastic; common very fine and fine tubular pores; violently effervescent; disseminated lime; moderately alkaline.

The A horizon ranges from gray to grayish brown in 10YR hue. Texture is silt loam or silty clay loam. Thickness ranges from 10 to 25 inches.

The C horizon ranges from dark gray, gray, and light gray to light brownish gray in 10YR and 2.5Y hue. Texture is loam, silt loam, clay loam, sandy clay loam, or silty clay loam.

The soil is moderately alkaline and calcareous throughout and may be slightly saline-alkali. Natural drainage is somewhat poor, and the water table is within a depth of 40 inches. Many areas, however, have been drained and the water table is at a depth of 60 inches or more.

139—Chino silty clay loam. This nearly level soil generally occurs on large alluvial fans.

About 10 percent of this mapping unit is included areas of Bolsa silty clay loam; 5 percent Omni clay; and 2 percent Tidal flats.

Depth to a seasonal water table is 42 to 60 inches. Runoff is very slow, and the erosion hazard is none to slight. Drainage has not been altered. The effective rooting depth of most crops is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit IIw–2 (19); range site not assigned; Storie index 72.

140—Chino silty clay loam, drained. This nearly level soil generally occurs on large alluvial fans. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Bolsa silty clay loam, drained; 5 percent Omni clay; 2 percent Mocho loam; and 2 percent Sorrento clay loam.

If the soil is bare, runoff is slow and the erosion hazard is slight. This soil is drained, and the water table is more than 60 inches below the surface. The effective rooting depth is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit I (19); range site not assigned; Storie index 81.

Cieneba Series

The Cieneba series consists of somewhat excessively drained soils. These soils formed in material weathered from granitic rocks of the Santa Ana Mountains and from the sandstone of the coastal foothills. Slopes are 9 to 75 percent. Elevation ranges from 200 to 4,000 feet. The vegetation is mostly brush. Precipitation is 14 to 25 inches, and the mean average air temperature is 59 to 62° F. The frost-free season is 200 to 340 days.

Typically, the surface layer is light brownish gray and pale brown sandy loam 7 inches thick. The underlying material is weathered granodiorite.

The soil is medium acid throughout. It is moderately rapidly permeable.

Cieneba soils are used mainly for watershed and wildlife habitat and to a limited extent for range.

Typical profile of Cieneba sandy loam, in an area of Cieneba-Rock outcrop complex, 15 to 30 percent slopes, in the Trabuco Ranger District, Cleveland National Forest (North), Orange County, about 800 feet south of the junction of the Main Divide Road and Horsethief Trail, SW¼SW¼ sec. 36, T. 5 S., R. 6 W., SBB&M.

A11—0 to 1 inch; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak thin and medium platy structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; medium acid; clear smooth boundary.

A12—1 to 7 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and medium roots; few medium tubular pores, few fine and medium interstitial pores; medium acid; abrupt smooth boundary.

Cr—7 to 20 inches; yellow, light brownish gray, white, and black weathered granodiorite; massive; hard to very hard; few roots in upper few inches; medium acid; grades into hard granodiorite at an undetermined depth below 20 inches.

The A horizon ranges from grayish brown, light brownish gray, or pale brown to yellowish brown in 10YR hue. Texture is fine gravelly sandy loam, coarse sandy loam, or sandy loam. Structure is generally granular or the soil is massive except for a platy crust in some areas. Dry consistence ranges from soft to hard. Thickness ranges from 5 to 19 inches.

The Cr horizon is weathered granodiorite of the Santa Ana Mountains area and soft sandstone of other coastal foothill areas.

Reaction ranges from medium acid to neutral throughout.

141—Cieneba sandy loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on or near ridgetops. It is only 15 to 19 inches deep over weathered bedrock.

About 5 percent of this mapping unit is included areas of San Andreas sandy loam; 5 percent Anaheim loam; and 3 percent Soper gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 2.0 to 3.0 inches. The effective rooting depth is 15 to 19 inches, but some brush roots penetrate deeper into the weathered granite or along cracks in the sandstone.

Present land use is pasture, range, and urban development. Capability unit VIe–1 (19); Shallow Loamy range site; Storie index 23.

142—Cieneba sandy loam, 30 to 75 percent slopes, eroded. This steep to very steep soil has a profile similar to the one described as typical of the series, but it is

eroded. It is only 5 to 15 inches deep over bedrock. In many places it is cut by gullies and intermittent drainage channels. Geologic erosion is active, and small landslips are common. Surface cobbles and stones are numerous in some areas.

About 5 percent of this mapping unit is included areas of San Andreas sandy loam; 5 percent Soper cobbly loam; 5 percent Calleguas clay loam; 10 percent an uneroded Cieneba sandy loam in the coastal foothill area; 6 percent Vista coarse sandy loam; 4 percent Tollhouse-Rock outcrop complex; and 3 percent Blasingame loam, in the Santa Ana Mountain area.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 0.75 to 2.5 inches. The effective rooting depth is 5 to 15 inches.

Present land use is limited to range, watershed, and wildlife habitat. Capability unit VIIe–1 (19) ; Shallow Loamy range site; Storie index 7.

143—Cieneba-Blasingame-Rock outcrop complex, 9 to 30 percent slopes. This strongly sloping to moderately steep mapping unit is about 35 percent Cieneba sandy loam, 30 percent Blasingame loam, and 25 percent Rock outcrop and large boulders. The Cieneba soil and Rock outcrop generally occur on ridgetops and on south- and west-facing side slopes. The Blasingame soil and Rock outcrop generally occur on north- and east-facing side slopes. About 10 percent of this mapping unit is included areas of Vista coarse sandy loam.

In Cieneba sandy loam, available water capacity is 2.0 to 3.0 inches and the effective rooting depth is 15 to 19 inches. In Blasingame loam, available water capacity is 2.5 to 4.0 inches and the effective rooting depth is 20 to 30 inches. Rock outcrop is granodiorite outcrop or boulders.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is limited to range, wildlife habitat, and watershed. Capability unit VIs–1 (19) ; Shallow Loamy-Rock outcrop complex range site; Storie index 17 (according to the proportion of dominant soils).

144—Cieneba-Rock outcrop complex, 9 to 30 percent slopes. This strongly sloping to moderately steep mapping unit commonly occurs on broad mountain ridgetops and side slopes in the Santa Ana Mountains. It is 30 percent granodiorite outcrop and boulders.

About 7 percent of this mapping unit is included areas of Vista coarse sandy loam; 4 percent Tollhouse soils; and 3 percent Blasingame loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The Cieneba soil has an available water capacity of 2.0 to 3.0 inches. For most plants it has an effective rooting depth of 15 to 19 inches. Some brush roots penetrate deeper into the weathered bedrock.

Present land use is limited to range, watershed, and wildlife habitat. Capability unit VIs–1 (19); Shallow Loamy-Rock outcrop complex range site; Storie index 14.

145—Cieneba-Rock outcrop complex, 30 to 75 percent slopes. This steep to very steep mapping unit occurs on hillsides or mountainsides. In the Santa Ana Mountain area, it is about 30 percent granodiorite outcrop and boulders. In coastal foothill areas, it is 10 to 35 percent sandstone outcrop.

About 5 percent of this mapping unit is included areas of Vista coarse sandy loam; 5 percent Tollhouse soil in the Santa Ana Mountain area; 5 percent San Andreas sandy loam; and 5 percent Anaheim loam in the coastal foothills.

If the soil is bare, runoff is rapid and the erosion hazard is high. Cieneba sandy loam has an available water capacity of 0.75 to 2.5 inches. For most plants it has an effective rooting depth of 5 to 15 inches. Some brush roots penetrate deeper into the weathered bedrock.

Present land use is limited to range, watershed, and wildlife habitat. Capability unit, Cieneba soil, VIIs–1 (19); Shallow Loamy-Rock outcrop complex range site; Storie index 4.

Corralitos Series

The Corralitos series consists of somewhat excessively drained soils on fans in long, narrow valleys. These soils formed in mixed coarse textured alluvium. Slopes are 0 to 5 percent. Elevation ranges from 50 to 1,500 feet. The vegetation is mainly annual grasses and forbs and some trees and brush generally near stream channels. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 230 to 300 days.

Typically, the surface layer is grayish brown loamy sand and loamy fine sand 9 inches thick. The underlying material is stratified light brownish gray and light gray loamy coarse sand, sand, and loamy fine sand to a depth of 60 inches or more.

The soil is medium acid throughout. It is rapidly permeable.

Corralitos soils are used for citrus, irrigated row crops, pasture, and range.

Typical profile of Corralitos loamy sand, on the Rancho Mission Viejo, Orange County, about 400 feet east of the Ortega Highway bridge (which is 2.4 miles east of San Juan Capistrano) and 100 feet north of the highway, SW¼NW¼ sec. 33, T. 7 S., R. 7 W., SBB&M.

A11—0 to 2 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; few fine pores; medium acid; abrupt smooth boundary.

A12—2 to 9 inches; grayish brown (10YR 5/2) loamy fine sand, dark gray (10YR 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine pores; medium acid; clear smooth boundary.

C1—9 to 21 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark gray (10YR 4/1) moist; single grained; loose, nonsticky and nonplastic; medium acid; gradual smooth boundary.

C2—21 to 32 inches; light gray (10YR 6/1) gray (10YR 5/1) and light brownish gray (10YR 6/2) sand, gray (10YR 5/1) and dark gray (10YR 4/1) moist; single grained; loose, nonsticky and nonplastic; medium acid; abrupt smooth boundary.

C3—32 to 35 inches; light brownish gray (10YR 6/2) loamy fine sand, dark gray (10YR

4/1) moist; massive; soft, very friable, nonsticky and nonplastic; medium acid; abrupt wavy boundary.

C4—35 to 60 inches; light brownish gray (10YR 6/2) sand, gray (10YR 5/1) moist; single grained; loose, nonsticky and nonplastic; medium acid.

The A horizon ranges from grayish brown to brown or pale brown to light brownish gray in 10YR hue. Texture is sand, loamy sand, or loamy fine sand. Structure may be granular, but in many places the soil is massive or single grained. Dry consistence ranges from loose to soft or slightly hard. Thickness ranges from 9 to 20 inches.

The C horizon ranges from pale brown, light brownish gray, and very pale brown to light gray in 10YR hue. Texture is generally sand, loamy sand, loamy coarse sand, or loamy fine sand. In places the soil is stratified. Reaction ranges from medium acid to neutral.

In some soils the underlying material is of contrasting texture. Color ranges from dark gray to light brownish gray. Texture is silt loam or silty clay loam. Thickness is 2 to 6 inches or more. Depth to such strata is generally 40 to 60 inches.

146—Corralitos loamy sand. This nearly level to gently sloping soil generally occurs as long narrow areas along stream channels. It has the profile described as typical of the series.

About 2 percent of this mapping unit is included areas of Capistrano sandy loam; 4 percent Metz loamy sand; 3 percent Soboba gravelly loamy sand, 0 to 5 percent slopes; 5 percent Riverwash; and 20 percent Corralitos soils that have a very fine sandy loam overwash 4 to 10 inches thick.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 4.0 to 5.5 inches. The effective rooting depth is 60 inches or more.

Present land use is irrigated row crops, citrus, pasture, and range. Capability unit IIIs–4 (19); Sandy range site; Storie index 68.

147—Corralitos loamy sand, moderately fine substratum. This nearly level to gently sloping soil generally occurs as long narrow areas along stream channels. The profile is similar to the one described as typical of the series, but there is a silt loam or silty clay loam layer 2 to 6 inches thick at a depth of 36 to 60 inches.

About 10 percent of this mapping unit is included areas of Corralitos loamy sand; 3 percent Corralitos soils that have a very fine sandy loam overwash; 2 percent Capistrano sandy loam; 2 percent Riverwash; and 5 percent Metz loamy sand, moderately fine substratum.

Permeability is rapid in the upper 40 inches and slow in the moderately fine underlying stratum. An intermittent water table is perched just above the finer textured stratum if rainfall is above normal or if the soils are overirrigated.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 5.5 to 6.0 inches. The effective rooting depth is 60 inches or more.

Present land use is irrigated row crops, citrus, pasture, and range. Capability unit IIs–4 (19); Sandy range site; Storie index 65.

Cropley Series

The Cropley series consists of well drained soils on fans and valley fill. These soils formed in fine textured alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Elevation ranges from 50 to 1,000 feet. The vegetation is annual grasses and forbs. Precipitation is 10 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 280 to 340 days.

Typically, the surface layer is very dark gray clay 29 inches thick. The underlying material is dark gray clay to a depth of 60 inches or more. The soil is mildly alkaline in the surface layer and moderately alkaline and slightly calcareous in the subsurface layer. The underlying material is moderately alkaline, has segregated lime, and increases from slightly calcareous to violently calcareous with increasing depth.

The soil is slowly permeable. Available water capacity is 8.0 to 10.0 inches. The effective rooting depth is 60 inches or more.

Cropley soils are used for dryland small grain, pasture, range, citrus, and urban development.

Typical profile of Cropley clay, 2 to 9 percent slopes, in Oso Creek Valley, about 3.0 miles southeast of El Toro, Orange County, NW¼SW¼ sec. 20, T. 6 S., R. 7 W., SBB&M.

Ap—0 to 3 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium granular structure; hard, firm, very sticky and plastic; few very fine roots; few very fine and fine tubular pores; mildly alkaline; abrupt smooth boundary.

A12—3 to 15 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong very coarse prismatic structure parting to moderate medium and coarse angular blocky; extremely hard, firm, very sticky and plastic; common very fine and few fine roots; common very fine tubular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

A13—15 to 29 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium and coarse angular blocky structure; extremely hard, firm, very sticky and plastic; common very fine and few fine roots; common very fine tubular pores; few small slickensides; slightly effervescent; moderately alkaline; gradual smooth boundary.

C1—29 to 38 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse angular blocky structure; extremely hard, firm, very sticky and plastic; few very fine roots; few very fine tubular pores; common small intersecting slickensides; slightly effervescent; lime in filaments and soft masses; moderately alkaline; gradual smooth boundary.

C2—38 to 49 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; very hard, firm, very sticky and plastic; very few very fine and fine roots; common very fine tubular pores; common small intersecting slickensides; violently effervescent; lime in filaments and soft masses; moderately alkaline; gradual irregular boundary.

C3—49 to 65 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; very hard, firm, very sticky and plastic; very few very fine and fine roots; common very fine tubular pores; common small intersecting slickensides; violently effervescent; lime in filaments and soft masses; moderately alkaline.

The A horizon ranges from dark gray to very dark gray in 10YR hue. Texture is heavy clay loam, silty clay, or clay. Structure ranges from granular to subangular blocky in the upper few inches. Reaction is neutral to moderately alkaline. The upper few inches is noncalcareous. In places the lower part is calcareous. Thickness ranges from 20 to 35 inches.

The C horizon ranges from dark gray, dark grayish brown, brown to yellowish brown in 10YR and 2.5Y hue. Texture is clay, silty clay loam, or clay loam. Structure is typically angular blocky; in places this horizon is massive. Dry consistence is extremely hard to hard. The C horizon is calcareous with or without segregated lime.

Intersecting slickensides occur in some parts of the profile. When dry, the soil has cracks 1 to 2 inches wide to a depth of 20 inches or more.

148—Cropley clay, 0 to 2 percent slopes. This nearly level soil generally occurs as irregular, oblong areas.

About 10 percent of this mapping unit is included areas of a soil that is very dark grayish brown or dark grayish brown clay but is otherwise similar to this Cropley soil; 5 percent Omni clay, drained; 3 percent Chino silty clay loam, drained; and 5 percent Bosanko clay.

If the soil is bare, runoff is slow and the erosion hazard is slight.

Present land use is urban development and citrus. Capability unit IIs–5 (19); Clayey range site; Storie index 54.

149—Cropley clay, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs as irregular, oblong areas. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Cropley clay, 0 to 2 percent slopes; 10 percent a soil that is very dark grayish brown to dark grayish brown clay but is otherwise similar to this Cropley soil; 7 percent Bosanko clay; and 3 percent Botella clay loam, 2 to 9 percent slopes.

If the soil is bare, runoff is medium and the erosion hazard is slight.

Present land use is citrus, barley, pasture, range, and urban development. Capability unit IIe–5 (19); Clayey range site; Storie index 47.

Escondido Series

The Escondido series consists of well drained soils on uplands in the Santa Ana Mountains. These soils formed in material weathered from metamorphosed sandstone. Slopes are 9 to 30 percent. Elevation ranges from 1,000 to 3,500 feet. The vegetation is mostly an oak-grass type. Precipitation is 16 to 25 inches, and the mean annual air temperature is about 60° F. The frost-free season is 240 to 300 days.

In a typical profile the surface layer is brown, slightly acid and medium acid very fine sandy loam 16 inches thick. The subsoil is light yellowish brown, medium acid very fine sandy loam 13 inches thick. Slightly weathered metamorphic sandstone is at a depth of 29 inches.

The soil is moderately permeable. Available water capacity is 3.0 to 5.5 inches. The effective rooting depth is 24 to 35 inches.

Escondido soils are used for pasture, range, watershed, and wildlife.

Typical profile of Escondido very fine sandy loam, 9 to 15 percent slopes, in the Trabuco Ranger District, Cleveland National Forest (north), NW¼SW¼ sec. 18, T. 7 S., R. 5 W., SBB&M; about 50 feet west of the trail in Oak Flats:

O1—½ inch to 0; litter of oak leaves, grass stems, small twigs, and tree branches.

A11—0 to 3 inches; brown (10YR 5/3) very fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine and fine tubular pores; 5 percent small angular pebbles; slightly acid; abrupt smooth boundary.

A12—3 to 16 inches; brown (10YR 5/3) very fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine and medium tubular pores; 5 percent angular pebbles; medium acid; gradual wavy boundary.

B2—16 to 29 inches; light yellowish brown (10YR 6/4) very fine sandy loam, few fine faint pinkish mottles, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few medium and coarse, many very fine and fine roots; common very fine and fine tubular pores; 5 percent pebbles; medium acid; gradual wavy boundary.

R—29 to 34 inches; light yellowish brown (10YR 6/4) slightly weathered metamorphosed sandstone, dark yellowish brown (10YR 4/4) moist.

The A horizon ranges from brown to yellowish brown in 10YR and 7.5YR hue. Texture is fine sandy loam, very fine sandy loam, or silt loam. The soil may be massive in the lower part. Dry consistence is slightly

hard to hard. Thickness ranges from 12 to 18 inches.

The B horizon ranges from pale brown, brown, light yellowish brown, or yellowish brown, to strong brown in 10YR and 7.5YR hue. Texture is fine sandy loam, very fine sandy loam, or silt loam. Reaction ranges from medium acid to neutral. Thickness ranges from 12 to 17 inches.

There may be a discontinuous C horizon. The water table is commonly perched above the R horizon after prolonged rain or irrigation.

These soils occur at elevations up to 700 feet higher than recognized elsewhere in California because of the warmer climate on the south- and west-facing slopes of the Santa Ana Mountains.

150—Escondido very fine sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs as irregular, oblong areas. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of fine sandy loam, 3 percent Exchequer soils, 3 percent Blasingame loam, and 10 percent less sloping or steeper Escondido very fine sandy loam. A few low outcrops of rock occur in some areas.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is pasture, range, watershed, and wildlife. Capability unit IVe–1 (19); Loamy range site; Storie index 51.

151—Escondido very fine sandy loam, 15 to 30 percent slopes. This moderately steep soil generally occurs as irregular, oblong areas.

About 10 percent of this mapping unit is included areas of Friant fine sandy loam, 3 percent Exchequer soils, 3 percent Blasingame loam, and 15 percent less sloping or steeper Escondido very fine sandy loam. A few low outcrops of rock occur in some areas.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range, watershed, and wildlife. Capability unit VIe–1 (19); Loamy range site; Storie index 39.

Exchequer Series

The Exchequer series consists of well drained and somewhat excessively drained soils in the Santa Ana Mountains. These soils formed in material weathered from metabasic rock. Slopes are 30 to 75 percent. Elevation ranges from 1,000 to 4,000 feet. The vegetation is generally dense brush, but there is some annual grass. Precipitation is 16 to 25 inches, and the mean annual temperature is about 59° F. The frost-free season is 220 to 300 days.

In a typical profile the soil is reddish brown gravelly silt loam. Fractured metaandesite is at a depth of 18 inches. The soil is slightly acid throughout. Low rock outcrops cover about 10 percent of the surface area.

The soil is moderately permeable. Available water capacity is 1.0 to 3.0 inches. The effective rooting depth is 8 to 18 inches.

Exchequer soils are used for watershed and wildlife and to a limited extent for range.

Typical profile of Exchequer gravelly silt loam, in an area of Exchequer-Rock outcrop complex, 30 to 75 percent slopes, ¼ mile south of Bear Spring along Main Divide Truck Trail, SE¼NE¼ sec. 29, T. 5 S., R. 6 W., SBB&M., Orange County:

A11—0 to 3 inches; reddish brown (5YR 4/4) gravelly silt loam, dark reddish brown (5YR 3/4) moist; weak fine and medium granular structure; soft, friable, nonsticky and nonplastic; common fine and medium, many very fine roots; many very fine, fine, and medium tubular pores; 15 percent 1- to 3-inch and 5 percent 4-inch angular rock fragments; slightly acid; clear wavy boundary.

A12—3 to 9 inches; reddish brown (5YR 4/4) gravelly silt loam, dark reddish brown (5YR 3/2) moist; massive; soft, friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; 20 percent 1- to 4-inch angular rock fragments; slightly acid; clear wavy boundary.

A13—9 to 18 inches; reddish brown (5YR 5/4) gravelly heavy silt loam, reddish brown (5YR 4/4) moist; massive; soft, friable, slightly sticky and plastic; few very fine and many fine and medium roots; many very fine tubular pores; 20 percent pebbles; slightly acid; abrupt broken boundary.

R—18 to 30 inches; fractured metaandesite; upper vertical fractures filled with soil material and few very fine and common medium and coarse roots.

The A horizon ranges from yellowish red to reddish brown or strong brown in 5YR or 7.5YR hue. Texture is gravelly loam, gravelly silt loam, or gravelly light clay loam. Reaction ranges from strongly acid to slightly acid. Structure typically ranges from weak granular to weak angular blocky. In places this horizon is massive. Thickness ranges from 8 to 18 inches.

These soils occur at elevations up to 2,000 feet higher than recognized elsewhere because of the warmer climate on the south- and west-facing slopes of the Santa Ana Mountains.

152—Exchequer-Rock outcrop complex, 30 to 75 percent slopes. This steep to very steep mapping unit occurs on mountainsides. It is about 10 percent low rock outcrops and about 65 percent Exchequer gravelly silt loam. The Exchequer soil has the profile described as typical of the series.

About 6 percent of this mapping unit is included areas of Friant fine sandy loam, 30 to 70 percent slopes; 3 percent Escondido very fine sandy loam; 3 percent Blasingame stony loam, 30 to 65 percent slopes; and 10 percent less sloping or steeper Exchequer-Rock outcrop complex.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is watershed, wildlife and, to a limited extent, range. Capability unit VIIs–1 (19); Shallow Loamy-Rock outcrop complex range site; Storie index 8.

Friant Series

The Friant series consists of somewhat excessively drained soils in the mountains. These soils formed in material weathered from fine grained metasedimentary rock. Slopes are 30 to 70 percent. Elevation ranges from 1,000 to 4,000 feet. The vegetation is mostly California sagebrush, black sage, flattop, buckwheat, and other common brush plants. Precipitation is 16 to 25 inches, and the mean annual air temperature is about 60° F. The frost-free season is 210 to 280 days.

In a typical profile the soil is brown gravelly fine sandy loam 17 inches thick. Very dark gray, fractured, extremely hard metasedimentary rock extends to a depth of 34 inches or more. The soil is slightly acid. About 2 percent of the soil surface is large, low rock outcrops.

Permeability is moderately rapid. Available water capacity is 1.0 to 2.0 inches. The effective rooting depth is 9 to 18 inches.

These soils are used for watershed, wildlife and, to a limited extent, for range.

Typical profile of Friant fine sandy loam, 30 to 70 percent slopes, in the Trabuco Ranger District, Cleveland National Forest (north), SE¼NW¼ sec. 31, T. 5 S., R. 6 W., SBB&M, Orange County, about ½ mile south of "Old Camp" on the Santiago Truck Trail:

A11—0 to 4 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, few fine and medium roots; very few fine tubular pores; about 25 percent angular pebbles; slightly acid; clear smooth boundary.

A12—4 to 17 inches; brown (10YR 5/3) gravelly fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common fine and medium, few very fine roots; few fine and medium tubular pores; common very fine interstitial pores; about 25 percent angular pebbles; slightly acid; abrupt irregular boundary.

R—17 to 34 inches; very dark gray (10YR 3/1) and about 10 percent light yellowish brown (10YR 6/4) and strong brown (7.5YR 5/6) fractured metasedimentary rock.

The A horizon ranges from brown to dark brown in 10YR hue. Texture is very fine sandy loam or sandy loam and in places is gravelly. Reaction ranges from medium acid to neutral. Thickness ranges from 9 to 18 inches. The bedrock is fractured metamorphosed fine grained sandstone or schist.

These soils occur at elevations up to 500 feet higher than those observed elsewhere in California because of the warmer climate on the west- and south-facing slopes of the Santa Ana Mountains.

153—Friant fine sandy loam, 30 to 70 percent slopes. This steep to very steep soil generally occurs in the mountains. It has the profile described as typical of the series.

About 7 percent of this mapping unit is included areas of Escondido very fine sandy loam, 3 percent Exchequer-Rock outcrop complex, 3 percent Cieneba-Rock outcrop complex, and 10 percent less sloping or steeper Friant soils.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is watershed, wildlife, and range. Capability unit VIIe–1 (19); Shallow Loamy range site; Storie index 9.

Gabino Series

The Gabino series consists of moderately steep and steep, well drained soils on terraces. These soils formed in weakly consolidated conglomerate. Slopes are 15 to 50 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is mainly annual grasses and forbs, stipa, and scattered brush. Precipitation is 12 to 20 inches, and the mean annual temperature is 60 to 63° F. The frost-free season is 290 to 350 days.

In a typical profile the surface layer is brown gravelly clay loam 10 inches thick. The subsoil is reddish brown gravelly clay 28 inches thick. The substratum is weakly consolidated conglomerate. The surface layer is medium acid, and the subsoil ranges from slightly acid to mildly alkaline with increasing depth.

The soil is slowly permeable. Available water capacity is 3.0 to 6.0 inches. The effective rooting depth is 26 to 40 inches.

Gabino soils are used for dryland pasture, range, and watershed.

Typical profile of Gabino gravelly clay loam, 15 to 30 percent slopes, about 2,800 feet east of Gabino Canyon, Ranch Mission Viejo, Orange County, NW¼NE¼ sec. 33, T. 7 S., R. 6 W., SBB&M.

A11—0 to 5 inches; brown (10YR 5/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; 2 to 3 percent cobbles, 15 percent pebbles; medium acid; clear smooth boundary.

A12—5 to 10 inches; brown (10YR 5/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine tubular pores; 15 percent pebbles; medium acid; clear smooth boundary.

B21t—10 to 26 inches; reddish brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) moist; strong coarse prismatic structure; extremely hard, very firm, very sticky and very plastic; very few very fine roots; very few very fine pores; many moderately thick clay films on peds; 15 percent pebbles; slightly acid; diffuse smooth boundary.

B22t—26 to 38 inches; reddish brown (5YR 4/3) gravelly clay, dark reddish brown (5YR 3/3) moist; strong coarse prismatic structure; extremely hard, very firm,

very sticky and very plastic; very few very fine roots; very few very fine pores; many moderately thick clay films on peds; 15 percent pebbles; mildly alkaline; abrupt smooth boundary.

Cr—38 to 50 inches; weakly consolidated conglomerate; pebbles and cobbles composed of mixed rounded crystalline rocks, some strongly weathered.

The A horizon ranges from brown to dark grayish brown in 10YR and 7.5YR hue. Texture is gravelly loam, cobbly loam, gravelly clay loam, or cobbly clay loam. This horizon is 12 to 20 percent pebbles or cobbles, or both. The surface is as much as 50 percent pebbles and cobbles. Structure is granular, subangular blocky, or prismatic parting to subangular blocky. Consistence is slightly hard or hard. Reaction is medium acid or slightly acid. Thickness ranges from 6 to 12 inches.

The Bt horizon is dark reddish gray or reddish brown in 5YR hue. Texture is gravelly clay, cobbly clay, gravelly sandy clay, or cobbly sandy clay. Thickness ranges from 20 to 28 inches.

The Cr horizon is gravelly or cobbly, or both, weakly consolidated conglomerate. Fifty to sixty percent of the pebbles and cobbles throughout the soil is extremely hard metamorphic rock. The rest is generally weathered granitic rock.

154—Gabino gravelly clay loam, 15 to 50 percent slopes. This moderately steep soil generally occurs as irregularly shaped areas. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Soper cobbly loam, 15 to 50 percent slopes; 5 percent Yorba cobbly sandy loam; 5 percent Myford sandy loam; and 10 percent less sloping or steeper Gabino gravelly clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range, watershed, and wildlife. Capability unit VIs–1 (19); Clayey range site; Storie index 11.

Garretson Series

The Garretson series consists of well drained soils on alluvial fans. These soils formed in material weathered dominantly from metasedimentary rock. Slopes are 2 to 9 percent. Elevation ranges from 700 to 1,500 feet. The vegetation is annual grasses, forbs, chamise, and sumac. Precipitation is 12 to 16 inches, and the mean annual temperature is about 63° F. The frost-free season is 250 to 300 days.

In a typical profile the surface layer is yellowish brown, slightly acid gravelly very fine sandy loam and gravelly loam. It is about 30 inches thick. The underlying material is yellowish brown, mildly alkaline gravelly loam and clay loam to a depth of 60 inches or more.

Permeability is moderate. Available water capacity is 6.0 to 10.0 inches. The effective rooting depth is 60 inches or more.

Garretson soils are used for citrus, dryland pasture, and range.

Typical profile of Garretson gravelly very fine sandy loam, 2 to 9 percent slopes, 50 feet west of National Forest Boundary and 70 feet south of the north boundary of the Temescal Ranch, Riverside County, SE¼SE¼ sec. 33, T. 4 S., R. 6 W., SBB&M.

A11—0 to 6 inches; yellowish brown (10YR 5/4) gravelly very fine sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; common very fine interstitial pores; 25 percent angular pebbles; slightly acid; clear smooth boundary.

A12—6 to 30 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; common fine and few medium tubular pores; 20 percent angular pebbles; slightly acid; gradual smooth boundary.

C1—30 to 36 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many fine and few medium tubular pores; 20 percent angular pebbles; mildly alkaline; gradual smooth boundary.

C2—36 to 40 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many fine tubular pores; 20 percent angular pebbles; mildly alkaline; gradual smooth boundary.

C3—40 to 54 inches; yellowish brown (10YR 5/4) gravelly light clay loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, sticky and plastic; few very fine roots; few fine tubular pores; 15 percent angular pebbles; mildly alkaline; gradual smooth boundary.

C4—54 to 60 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; 20 percent angular pebbles; mildly alkaline.

The A horizon ranges from brown or dark yellowish brown to yellowish brown in 10YR hue. Reaction is slightly acid to neutral. Thickness ranges from 10 to 34 inches.

The C horizon ranges from pale brown or brown to yellowish brown in 10YR hue. Reaction ranges from slightly acid to mildly alkaline.

155—Garretson gravelly very fine sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on alluvial fans and in long narrow valleys. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included

areas of Corralitos loamy sand, 5 percent Hanford sandy loam, and 5 percent Soboba gravelly loamy sand. Also included are small areas where slopes are 0 to 2 percent and some where slopes are 9 to 15 percent.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate.

Present land use is citrus, dryland pasture, and range. Capability unit IIe–1 (19); Loamy range site; Storie index 72.

Hanford Series

The Hanford series consists of well drained soils on alluvial fans and alluvial plains. These soils formed in granitic alluvium. Slopes are 2 to 9 percent. Elevation ranges from 700 to 1,500 feet. The vegetation is annual grasses, forbs, and chamise. Precipitation is 12 to 16 inches, and the mean annual air temperature is about 63° F. The frost-free season is 250 to 280 days.

In a typical profile the surface layer is grayish brown slightly acid sandy loam 14 inches thick. The underlying material is pale brown, grayish brown, and very pale brown, neutral sandy loam and fine gravelly loamy sand to a depth of 60 inches or more.

Permeability is moderately rapid. Available water capacity is 7.0 to 9.0 inches. The effective rooting depth is 60 inches or more.

Hanford soils are used for citrus, olives, dryland pasture, and some urban development.

Typical profile of Hanford sandy loam, 2 to 9 percent slopes, about 50 feet southeast of the Ortega Highway and 50 feet southwest of the National Forest Boundary, Riverside County, SW¼SW¼ sec. 11 (projected) T. 6 S., R. 5 W., SBB&M.

Ap—0 to 4 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine roots; common fine tubular pores; few very fine interstitial pores; slightly acid; clear smooth boundary.

A12—4 to 14 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine tubular pores; few very fine interstitial pores; slightly acid; gradual smooth boundary.

C1—14 to 31 inches; pale brown (10YR 6/3) and grayish brown (10YR 5/2) sandy loam, brown (10YR 4/3) and very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine interstitial pores; few fine tubular pores; neutral; clear smooth boundary.

C2—31 to 48 inches; pale brown (10YR 6/3) and grayish brown (10YR 5/2) sandy loam, brown (10YR 5/3) and very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; neutral; gradual smooth boundary.

C3—48 to 60 inches; very pale brown (10YR 7/4), pale brown (10YR 6/3), and grayish brown (10YR 5/2) fine gravelly loamy sand, brown (10YR 5/3) and very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; 20 percent granitic pebbles; neutral.

The A horizon ranges from pale brown to grayish brown in 10YR hue. Texture is loamy fine sand, coarse sandy loam, or sandy loam. Reaction ranges from slightly acid to neutral. Thickness ranges from 8 to 30 inches.

The C horizon ranges from very pale brown, pale brown, or grayish brown, or a mixture of these colors in 10YR hue. Texture is sandy loam with strata of loamy sand or gravelly loamy sand common in the lower part. Reaction ranges from slightly acid to mildly alkaline.

156—Hanford sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on alluvial plains and fans and in long narrow valleys. It has the profile described as typical of the series.

Included with this soil in mapping are small areas of Corralitos loamy sand, Capistrano sandy loam, Garretson gravelly very fine sandy loam, and some areas of Hanford soils where slopes are 0 to 2 percent or 9 or 15 percent.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate.

This soil is used for citrus, olives, dryland pasture, and urban development. Capability unit IIe–1 (19); Sandy range site; Storie index 85.

Hueneme Series

The Hueneme series consists of poorly drained soils on alluvial fans and flood plains. These soils formed in mixed alluvium. Slopes are 0 to 2 percent. Elevation ranges from 5 to 350 feet. The vegetation is annual grasses, mustard, and plants that require moisture. Precipitation is 12 to 15 inches, and the mean annual air temperature is about 61° F. The frost-free season is 300 to 350 days.

In a typical profile the surface layer is light brownish gray fine sandy loam 27 inches thick. The underlying material is stratified light gray and light brownish gray loamy sand, silt loam, loamy fine sand, fine sandy loam, and silty clay loam. It extends to a depth of 60 inches or more. There are prominent or distinct mottles in most horizons.

The soil is moderately alkaline throughout and is calcareous in all but the loamy fine sand horizon. Permeability is moderately rapid.

Hueneme soils are used for row crops, field crops, and urban development.

Typical profile of Hueneme fine sandy loam, about 200 feet southeast from the corner of Magnolia Avenue and Atlanta Avenue, Huntington Beach, Orange County, NW¼NW¼ sec. 18 (projected) T. 6 S., R. 10 W., SBB&M.

Ap1—0 to 8 inches; light brownish gray (10YR

6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; few very fine tubular pores; slightly effervescent; disseminated lime; moderately alkaline; abrupt smooth boundary.

Ap2—8 to 16 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; slightly effervescent; disseminated lime; moderate alkaline; clear wavy boundary.

A13—16 to 27 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common very fine roots; few very fine and common fine tubular pores; slightly effervescent; disseminated lime; moderately alkaline; abrupt smooth boundary.

IIC1—27 to 32 inches; light gray (10YR 7/2) loamy sand, grayish brown (10YR 5/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and fine interstitial pores; very slightly effervescent; disseminated lime; moderately alkaline; some 4- to 6-inch diameter pockets of material from A horizon; clear smooth boundary.

IIIC2—32 to 35 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; common fine prominent brownish yellow (10YR 6/6) mottles, yellowish brown (10YR 5/6) moist; weak medium platy structure; slightly hard, firm, slightly sticky and slightly plastic; very few very fine roots; common very fine and fine tubular pores; strongly effervescent; disseminated lime; moderately alkaline; abrupt smooth boundary.

IVC3—35 to 42 inches; light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) loamy fine sand, grayish brown (10YR 5/2) and light yellowish brown (10YR 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine tubular pores; moderately alkaline; abrupt wavy boundary.

VC4—42 to 44 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; common fine distinct light gray (10YR 7/1) and light yellowish brown (10YR 6/4) mottles, gray (10YR 6/1) and dark yellowish brown (10YR 4/4) moist; massive; weak medium bedding; soft, friable, nonsticky and nonplastic; few very fine and fine tubular pores; slightly effervescent; disseminated lime; moderately alkaline; abrupt wavy boundary.

VIC5—44 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; many medium distinct olive yellow (2.5Y 6/6) and brownish yellow (10YR 6/6) mottles, olive brown (2.5Y 4/4) and brownish yellow (10YR 6/6) moist; moderate coarse prismatic structure; hard, firm, sticky and plastic; common very fine and fine tubular pores; slightly effervescent; disseminated lime; moderately alkaline; few sea shells; some threadlike salts.

The A horizon ranges from light gray to light brownish gray to pale brown in 10YR and 2.5Y hue. Texture is sandy loam or fine sandy loam. Structure typically ranges from platy or granular to subangular blocky. In places this horizon is massive. Dry consistence ranges from soft to slightly hard or hard because of cultivation. Reaction is generally mildly alkaline, but may be strongly alkaline in saline-alkali areas. The soil ranges from slightly to violently calcareous. Thickness ranges from 10 to 20 inches.

In many places the C horizon contains thin strata of organic material.

157—Hueneme fine sandy loam. This nearly level soil generally occurs on large alluvial fans or flood plains.

About 5 percent of this mapping unit is included areas of Bolsa silt loam, 2 percent San Emigdio fine sandy loam, and 5 percent Hueneme fine sandy loam, drained.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 7.0 to 9.0 inches. The water table is at a depth of 40 to 60 inches. The effective rooting depth for most crops is more than 60 inches.

Present land use is row crops, field crops, and urban development. Capability unit IIw–2 (19); range site not assigned; Storie index 76.

158—Hueneme fine sandy loam, drained. This nearly level soil generally occurs on large alluvial fans or flood plains. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Bolsa silt loam, drained; 5 percent San Emigdio fine sandy loam, 0 to 2 percent slopes; and 5 percent Hueneme fine sandy loam.

Drainage has been altered by the lowering of the water table and by pumping wells or constructing flood control channels. The water table is now below 60 inches at all times.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 7.0 to 9.0 inches. The effective rooting depth is 60 inches or more.

Present land use is row crops, field crops, and urban development. Capability unit I (19); range site not assigned; Storie index 85.

Los Posas Series

The Las Posas series consists of well drained soils on uplands. These soils formed in material weathered from gabbro. Slopes are 15 to 50 percent. Elevation

ranges from 1,000 to 3,000 feet. The vegetation is chaparral and an understory of short grasses. Precipitation is 16 to 25 inches, and the mean annual air temperature is about 61° F. The frost-free season is 240 to 320 days.

In a typical profile the surface layer is reddish brown gravelly loam and loam 9 inches thick. The subsoil is dark red clay 18 inches thick. The substratum is yellowish red weathered gabbro to a depth of 44 inches or more.

The soil is neutral throughout. Permeability is moderately slow. Available water capacity is 3.0 to 6.5 inches. The effective rooting depth is 26 to 40 inches.

Las Posas soils are used for range, watershed, and wildlife.

Typical profile of Las Posas gravelly loam, 15 to 50 percent slopes, about ¾ mile east of Tenajo Truck Trail along Los Alamos Truck Trail, Riverside County, SW¼NW¼ sec. 23, T. 7 S., R. 5 W., SBB&M.

O1—¼ inch to 0; fine litter of partly decomposed leaves and twigs.

A1—0 to 5 inches; reddish brown (5YR 4/4) gravelly loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few fine and common very fine roots; few medium common very fine and fine tubular pores; 20 percent pebbles, 5 percent angular cobbles; 5 percent stones and cobbles on the surface; neutral; clear smooth boundary.

A3—5 to 9 inches; reddish brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine and coarse roots; common very fine, fine, and medium tubular pores; many thin clay films on peds; 5 percent angular pebbles; neutral; abrupt smooth boundary.

B2t—9 to 27 inches; dark red (2.5YR 3/6) clay, dark red (2.5YR 3/6) moist; strong coarse angular blocky structure; very hard, firm, very sticky and plastic; few very fine and coarse roots; common very fine interstitial pores; continuous clay films on peds and in pores; 5 percent angular pebbles, few 3 to 4-inch unweathered rock fragments in upper part of this horizon; neutral; gradual wavy boundary.

Cr—27 to 44 inches; yellowish red (5YR 5/6) weathered gabbro, yellowish red (5YR 4/6) moist; very few very fine and medium roots; many thick clay films on fractures; neutral.

The A horizon ranges from dark brown to reddish brown in 5YR or 7.5Y hue. Texture is gravelly fine sandy loam, gravelly loam, loam, or gravelly clay loam. Structure ranges from granular to subangular blocky. Reaction is slightly acid to neutral. Thickness ranges from 8 to 16 inches

The A3 horizon is generally slightly higher in clay and may be gravelly. Structure is subangular or angular blocky.

The B2t horizon ranges from dark red to dark reddish brown to reddish brown in 2.5YR hue. Texture is heavy clay loam or clay. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 18 to 24 inches. Depth to weathered bedrock is 26 to 40 inches.

159—Las Posas gravelly loam, 15 to 50 percent slopes. This moderately steep to steep soil generally occurs on broad ridgetops and on side slopes. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Friant fine sandy loam, 5 percent Blasingame stony loam, 5 percent Cieneba sandy loam, and 10 percent less sloping or steeper Las Posas soil.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range, watershed, and wildlife. Capability unit VIIe–1 (19); Loamy range site; Storie index 13.

Laughlin Series

The Laughlin series consists of well drained soils on uplands. These soils formed in material weathered from metamorphic rock. Slopes are 30 to 50 percent. Elevation ranges from 3,000 to 5,500 feet. The vegetation is brush, some small areas of annual grasses, and some areas of semidense to open stands of Coulter pine and oak. Precipitation is 20 to 30 inches, and the mean annual air temperature is about 57° F. The frost-free season is 150 to 180 days.

In a typical profile the surface layer is brown gravelly loam and loam 10 inches thick. The subsoil is brown loam and yellowish brown gravelly clay loam 29 inches thick. Yellowish brown metamorphic bedrock is at a depth of 39 inches.

The soil is medium acid in the upper 3 inches of the surface layer and slightly acid below. It is moderately permeable. Available water capacity is 3.0 to 6.0 inches. The effective rooting depth is 24 to 40 inches for annual grasses, but brush and tree roots can easily penetrate the metamorphic rock along fractures.

Laughlin soils are used for watershed, wildlife, recreation and, to a limited extent, for livestock grazing.

Typical profile of Laughlin gravelly loam, 30 to 50 percent slopes, in the Trabuco Ranger District, Cleveland National Forest (north), Orange County, about ½ mile north-northwest of Santiago Peak along Main Divide Road, SE¼SE¼ sec. 19, T. 5 S., R. 6 W., SBB&M.

O1—½ inch to 0; partly decomposed grass stems, leaves, and roots; approximately 2 percent 3- to 10-inch and 5 percent ¼- to 3-inch angular rock fragments.

A11—0 to 3 inches; brown (10YR 4/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky and nonplastic; many very

fine roots; many very fine pores; about 5 percent cobbles and 15 percent angular pebbles; medium acid; clear smooth boundary.

A12—3 to 10 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine pores; about 2 percent cobbles and 5 percent angular pebbles; slightly acid; clear smooth boundary.

B21—10 to 23 inches; brown (10YR 5/3) heavy loam, dark brown (10YR 4/3) moist; weak very fine, fine, and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium common very fine and fine roots; common very fine, fine, and medium pores; about 10 percent angular pebbles; slightly acid; gradual smooth boundary.

B22—23 to 32 inches; yellowish brown (10YR 5/4) gravelly light clay loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few coarse and common very fine, fine, and medium roots; common very fine, fine, and medium tubular pores; 20 percent angular pebbles; slightly acid; gradual smooth boundary.

B23—32 to 39 inches; yellowish brown (10YR 5/4) gravelly light clay loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine and common medium roots; common very fine, fine and medium pores; about 35 percent angular pebbles; slightly acid; gradual smooth boundary.

R—39 to 50 inches; yellowish brown metamorphic bedrock.

The A horizon ranges from grayish brown or brown to dark yellowish brown in 10YR hue. Texture is gravelly fine sandy loam, gravelly loam, gravelly light clay loam, or loam. Thickness ranges from 8 to 11 inches. This horizon is 5 to 20 percent angular rock fragments.

The B horizon ranges from brown to yellowish brown to dark yellowish brown in 10YR hue. Texture is gravelly heavy loam, gravelly light clay loam, or loam. Thickness ranges from 16 to 29 inches. Reaction is slightly acid to medium acid.

This soil has a higher base saturation than is typical of Laughlin soils elsewhere in California.

160—Laughlin gravelly loam, 30 to 50 percent slopes. This steep soil generally occurs on north-facing mountainsides. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Exchequer-Rock outcrop complex, 2 percent Escondido very fine sandy loam, and 8 percent Friant fine sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

This soil is used for watershed, wildlife, recreation and, to a limited extent, for range. Capability unit VIIe–1 (20) ; Loamy range site; Storie index 19.

Marina Series

The Marina series consists of somewhat excessively drained soils on terraces near the coast. These soils formed in old eolian sands. Slopes are 0 to 9 percent. Elevation ranges from 50 to 600 feet. The vegetation is mainly annual grasses and forbs and some areas of scattered low brush. Precipitation is 12 to 15 inches, and the mean annual air temperature is about 61° F. The frost-free season is 320 to 365 days.

In a typical profile the surface layer is grayish brown, light brownish gray, and pale brown loamy sand 33 inches thick. The subsoil is light yellowish brown and light gray loamy sand 27 inches thick and less than 10 percent ⅛- to 1-inch wavy bands of dark brown sandy loam. The substratum is very pale brown sand and a few ¼- to ½-inch wavy bands of dark brown sandy loam.

The soil is medium acid throughout. It is moderately permeable. Available water capacity is 3.5 to 5.0 inches. The effective rooting depth is 60 inches or more.

Marina soils are used for barley, pasture, range, and urban development.

Typical profile of Marina loamy sand, 2 to 9 percent slopes, at the west end and on the east side of Scenic Drive, Dana Point, Orange County, NW¼SW¼ sec. 21, T. 8 S., R. 8 W., SBB&M.

A11—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine tubular pores; many very fine interstitial pores; medium acid; diffuse wavy boundary.

A12—7 to 12 inches; light brownish gray (10YR 6/2) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine tubular pores; many very fine interstitial pores; medium acid; diffuse wavy boundary.

A13—12 to 33 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine tubular pores; many very fine interstitial pores; medium acid; abrupt irregular boundary.

B2—33 to 56 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; common very fine tubular pores; many very fine interstitial

pores; six continuous distinct, wavy, dark brown (7.5YR 4/4) heavy sandy loam lamellae (two ⅛-inch; two ¼-inch, and two 1-inch thick bands); medium acid; gradual smooth boundary.

B3—56 to 60 inches; light gray (10YR 7/2) loamy sand, pale brown (10YR 6/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; many very fine interstitial pores; several continuous distinct, wavy, ⅛- and ¼-inch thick dark brown (7.5YR 4/4) heavy sandy loam lamellae; medium acid; gradual smooth boundary.

C—60 to 80 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; massive; slightly hard, loose, nonsticky and nonplastic; many very fine interstitial pores; several ¼- to ½-inch thick, wavy, dark brown (10YR 4/3 and 7.5YR 4/4) sandy loam lamellae; medium acid.

The A horizon ranges from light brownish gray or pale brown to grayish brown or brown in 10YR hue. It ranges from single grain to massive. Texture is loamy sand or loamy fine sand. Dry consistence ranges from loose to slightly hard. Reaction ranges from slightly acid to medium acid. Thickness ranges from 10 to 33 inches.

The B horizon ranges from light yellowish brown to light gray to pale brown or light brown in 10YR and 7.5YR hue. It has dark brown to reddish brown clay bands in 7.5YR and 5YR hue. Texture is loamy sand or loamy fine sand and lamellae of sandy loam to heavy sandy loam. Lamellae are slightly firmer than matrix. Reaction ranges from medium acid to neutral. Thickness ranges from 20 to 27 inches. Lamellae are ⅛- to 1-inch thick.

161—Marina loamy sand, 0 to 2 percent slopes. This nearly level soil generally occurs on terraces near the coast.

About 5 percent of this mapping unit is included areas of soils that are sandy loam throughout but are otherwise similar to this Marina soil; 5 percent soils having a weakly cemented sandy substratum; and 3 percent Myford sandy loam, thick surface, 0 to 2 percent slopes.

If the soil is bare, runoff is slow and the erosion hazard is slight.

These soils are used for field crops, pasture, range, and urban development. Capability unit IIIs–4 (19); Sandy range site; Storie index 90.

162—Marina loamy sand, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on terraces near the coast. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of soils that are sandy loam throughout but are otherwise similar to this Marina soil; 5 percent soils having a weakly cemented sandy substratum; 3 percent Myford sandy loam, thick surface, 2 to 9 percent slopes; and 10 percent less sloping or steeper Marina loamy sand.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate.

These soils are used for field crops, pasture, range, and urban development. Capability unit IVs–4 (19); Sandy range site; Storie index 65.

Metz Series

The Metz series consists of somewhat excessively drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slopes are 0 to 5 percent. Elevation ranges from 25 to 1,500 feet. The vegetation is annual grasses and forbs. Precipitation is 12 to 18 inches, and the mean annual air temperature is about 62° F. The frost-free season is 270 to 350 days.

In a typical profile the surface layer is pale brown and brown loamy sand 17 inches thick. The underlying material is stratified pale brown and very pale brown loamy sand, sandy loam, and very fine sandy loam to a depth of 63 inches or more.

The soil is moderately alkaline and calcareous throughout. It is moderately permeable.

Metz soils are used for row crops, field crops, and urban development.

Typical profile of Metz loamy sand, on the Irvine Ranch, S¼N¼ sec. 106 (by private survey), Orange County, 500 feet northeast of Hines Nursery:

Ap1—0 to 3 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; many very fine and fine roots; many very fine tubular pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—3 to 10 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; common very fine roots; common very fine and many fine tubular pores; violently effervescent; moderately alkaline; clear smooth boundary.

A13—10 to 17 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; violently effervescent; moderately alkaline; clear smooth boundary.

C1—17 to 20 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; few very fine tubular pores; violently effervescent; moderately alkaline; clear smooth boundary.

C2—20 to 33 inches; pale brown (10YR 6/3) light sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine and common fine tubular pores; violently effervescent; moderately alkaline; gradual wavy boundary.

C3—33 to 38 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and

nonplastic; few very fine and common fine tubular pores; violently effervescent; moderately alkaline; gradual smooth boundary.

C4—38 to 47 inches; very pale brown (10YR 7/3) loamy coarse sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; few very fine and common fine tubular pores; 10 percent ½-inch and smaller pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC5—47 to 63 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium tubular pores; violently effervescent; moderately alkaline.

The A horizon ranges from light brownish gray to pale brown or brown in 10YR hue. Texture is loamy sand or light sandy loam. Thickness ranges from 10 to 20 inches. Reaction is neutral to moderately alkaline. In places this horizon is calcareous.

The C horizon ranges from light gray, light brownish gray, and pale brown to very pale brown in 10YR hue. Texture, which varies because of stratification, ranges from very fine sandy loam to sand. Reaction is neutral to moderately alkaline. Some horizons are calcareous. In some areas the C horizon is silt loam or silty clay loam below a depth of 40 inches.

163—Metz loamy sand. This nearly level to gently sloping soil generally occurs on large fans and on flood plains. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of San Emigdio fine sandy loam, 5 percent Hueneme fine sandy loam, 3 percent Corralitos loamy sand, 2 percent Riverwash, and 10 percent Metz loamy sand, moderately fine substratum.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 4.0 to 6.0 inches. The effective rooting depth is 60 inches or more.

This soil is used for row crops, field crops, and urban development. Capability unit IIIs–4 (19) ; Sandy range site; Storie index 80.

164—Metz loamy sand, moderately fine substratum. This nearly level to gently sloping soil generally occurs on large fans and on flood plains. It has a profile similar to the one described as typical of the series but generally has a 2- to 6-inch layer of dark gray to light brownish gray silty clay loam or silt loam 40 to 60 inches below the surface. In places the moderately fine textured material is mottled.

About 5 percent of the mapping unit is included areas of San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes; 3 percent Corralitos loamy sand; 5 percent Hueneme fine sandy loam; and 10 percent Metz loamy sand.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 5.0 to 6.0 inches. The effective rooting depth is 60 inches or more. The water table is intermittently perched above the moderately fine textured layer after above normal rainfall or after irrigation.

This soil is used for row crops, field crops, and urban development. Capability unit IIs–4 (19) ; Sandy range site; Storie index 72.

Mocho Series

The Mocho series consists of well drained soils on alluvial fans and flood plains. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Elevation ranges from 50 to 700 feet. The vegetation is annual grasses and forbs and some sycamore trees. Precipitation is 12 to 16 inches, and the mean annual air temperature is 59 to 62° F. The frost-free season is 270 to 340 days.

In a typical profile the surface layer is brown and grayish brown loam 31 inches thick. The next layers are light brownish gray, brown, and pale brown stratified fine sandy loam, silty clay loam, and loam to a depth of 61 inches or more.

The soil is moderately alkaline and calcareous throughout. It is moderately permeable. The effective rooting depth is 60 inches or more.

Mocho soils are used for irrigated crops, citrus, and urban development.

Typical profile of Mocho loam, 0 to 2 percent slopes, about 25 feet west of Grand Avenue and ¼ mile south of McFadden Avenue, Santa Ana, NE¼NE¼ sec. 19 (projected), T. 5 S., R. 9 W., SBB&M.

A11—0 to 2 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium and thick platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; very few very fine tubular pores; very slightly calcareous; moderately alkaline; abrupt smooth boundary.

A12—2 to 15 inches; grayish brown (10YR 5/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular and angular blocky structure; hard, friable, sticky and plastic; common very fine roots in the upper 2 inches, very few very fine and common fine and medium roots below; common fine and medium and few coarse tubular pores; strongly calcareous; moderately alkaline; clear wavy boundary.

A13—15 to 31 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; very few fine and medium roots; many very fine, fine, medium, and coarse tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

IIC1—31 to 45 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; very few very fine and common medium and coarse roots; common very fine and fine and many medium

and coarse tubular pores; strongly calcareous; moderately alkaline; abrupt smooth boundary.

IIC2—45 to 52 inches; brown (10YR 5/3) light silty clay loam, dark brown (10YR 3/3) moist; massive; slightly hard, firm, sticky and plastic; very few very fine, fine, medium, and coarse roots; common very fine, fine, medium, and coarse tubular pores; strongly calcareous; disseminated lime in some fine filaments; moderately alkaline; clear smooth boundary.

IIC3—52 to 61 inches; pale brown (10YR 6/3) heavy loam, brown (10YR 4/3) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; very few very fine and fine roots; common very fine, fine, medium, and coarse tubular pores; violently calcareous; disseminated lime in medium sized filaments and soft masses; moderately alkaline.

The A horizon ranges from brown to grayish brown or dark grayish brown in 10YR hue. Texture is sandy loam, loam, or clay loam. Structure ranges from granular or platy to angular and subangular blocky. This horizon is very slightly to strongly calcareous. Thickness ranges from 10 to 31 inches.

The C horizon ranges from light brownish gray to light grayish brown to brown or pale brown in 10YR or 2.5Y hue. There are few mottles below a depth of 40 inches. Texture is loam, fine sandy loam, or silty clay loam stratified with loamy sand, sandy loam, and silt. In a few places there is a buried A horizon. The C horizon is massive or has subangular blocky structure. Dry consistence ranges from slightly hard to dry.

165—Mocho sandy loam, 0 to 2 percent slopes. This nearly level soil generally occurs on alluvial fans or flood plains. It has a profile similar to the one described as typical of the series, but the surface layer is sandy loam 10 to 14 inches thick.

About 5 percent of this mapping unit is included areas of Mocho loam; 5 percent Sorrento sandy loam, 0 to 2 percent slopes; and 5 percent San Emigdio fine sandy loam, 0 to 2 percent slopes.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 9.5 to 12.0 inches.

Present land use is irrigated crops, citrus, and urban development. Capability unit I (19); Loamy range site; Storie index 95.

166—Mocho loam, 0 to 2 percent slopes. This nearly level soil generally occurs on fans or flood plains. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Mocho sandy loam; 5 percent Sorrento loam, 0 to 2 percent slopes; 3 percent Bolsa silt loam, drained; and 3 percent Chino silty clay loam, drained.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 9.5 to 12.0 inches.

Present land use is irrigated crops, citrus, and urban development. Capability unit I (19); Loamy range site; Storie index 100.

167—Mocho loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on fans or flood plains.

About 10 percent of this mapping unit is included areas of Mocho sandy loam; 5 percent Sorrento loam, 2 to 9 percent slopes; and 3 percent Botella loam, 2 to 9 percent slopes.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate. Available water capacity is 9.5 to 12.0 inches.

Present land use is irrigated crops, citrus, range, and urban development. Capability unit IIe–1 (19); Loamy range site; Storie index 90.

Modjeska Series

The Modjeska series consists of well drained soils on terraces. These soils formed in mixed alluvium. Slopes are 0 to 30 percent. Elevation ranges from 200 to 1,500 feet. The vegetation is annual grasses and forbs and some brush along terrace breaks. Precipitation is 14 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 280 to 330 days.

In a typical profile the surface layer and upper part of the subsoil are brown gravelly loam 14 inches thick. The rest of the subsoil is reddish brown and light brown very cobbly loam 49 inches thick. The substratum is light brown very gravelly loamy sand to a depth of 71 inches or more.

The soil is slightly acid throughout. It is moderately permeable. Available water capacity is 4.5 to 6.0 inches. The effective rooting depth is more than 60 inches.

Modjeska soils are used for citrus, dryland barley, dryland pasture, and urban development.

Typical profile of Modjeska gravelly loam, 2 to 9 percent slopes, 300 feet west of a private road and 0.9 mile north-northeast of triangulation point 1116, on the west side of Planto Traubuco, Rancho Mission Viejo, Orange County, NW¼NW¼ sec. 22, T. 6 S., R. 7 W., SBB&M.

Ap—0 to 5 inches; brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; few very fine tubular pores; 20 percent pebbles; slightly acid; abrupt smooth boundary.

B1—5 to 14 inches; brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 20 percent pebbles; slightly acid; gradual smooth boundary.

B21t—14 to 28 inches; reddish brown (5YR 5/3) very cobbly loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; many fine interstitial pores; common thin clay films line the pores; many moderately thick clay films around cobbles and pebbles;

30 percent cobbles and 20 percent pebbles; slightly acid; gradual smooth boundary.

B22t—28 to 46 inches; reddish brown (5YR 5/3) very cobbly loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; many fine interstitial pores; many thin clay films as bridges; many moderately thick clay films around cobbles and pebbles; 35 percent cobbles and 25 percent pebbles; slightly acid; gradual smooth boundary.

B3—46 to 63 inches; light brown (7.5YR 6/4) very cobbly loam, brown (7.5YR 4/4) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 40 percent cobbles and 35 percent pebbles; slightly acid; clear smooth boundary.

C—63 to 71 inches; light brown (7.5YR 6/4) very gravelly loamy sand, brown (7.5YR 5/4) moist; single grained; loose, nonsticky and nonplastic; few very fine roots; 50 percent pebbles and 30 percent cobbles; slightly acid.

The A horizon ranges from brown to grayish brown in 7.5YR and 10YR hue. Texture is gravelly loam or gravelly very fine sandy loam. Structure ranges from granular to subangular blocky. Dry consistence ranges from slightly hard to hard. Thickness ranges from 3 to 11 inches.

The B2 horizon ranges from reddish brown to brown in 5YR and 7.5YR hue. Texture is very gravelly loam or very cobbly loam. Structure ranges from granular to subangular blocky. Dry consistence ranges from slightly hard to hard. Thickness ranges from 17 to 32 inches.

The C horizon is very pale brown, pale brown, light brown, yellowish brown, brown, or reddish brown in 5YR, 7.5YR, or 10YR hue. Texture is very gravelly or very cobbly loam or very gravelly or very cobbly loamy sand.

The profile is 35 to 50 percent or more coarse fragments.

168—Modjeska gravelly loam, 0 to 2 percent slopes. This nearly level soil generally occurs on broad terraces.

About 5 percent of this mapping unit is included areas of Myford sandy loam, thick surface, 0 to 2 percent slopes; 3 percent Myford sandy loam, 0 to 2 percent slopes; and 5 percent Yorba gravelly sandy loam.

If the soil is bare, runoff is slow and the erosion hazard is slight.

Present land use is urban development and citrus. Capability unit IIIs–4 (19); Loamy range site; Storie index 64.

169—Modjeska gravelly loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on broad terraces. It has the profile described as typical of the series.

About 4 percent of this mapping unit is included areas of Myford sandy loam, 2 to 9 percent slopes, eroded; 3 percent Myford sandy loam, 2 to 9 percent slopes; and 3 percent Yorba gravelly sandy loam, 2 to 9 percent slopes.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate.

Present land use is citrus, dryland barley, and dryland pasture. Capability unit IIIe–4 (19); Loamy range site; Storie index 58.

170—Modjeska gravelly loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on side slopes of terraces.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 9 to 15 percent slopes; and 5 percent Yorba gravelly sandy loam, 9 to 15 percent slopes.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is citrus, dryland barley, dryland pasture, and range. Capability unit IVe–1 (19); Loamy range site; Storie index 54.

171—Modjeska gravelly loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on side slopes of terraces.

About 3 percent of this mapping unit is included areas of Yorba gravelly sandy loam, 15 to 30 percent slopes; 3 percent Gabino gravelly clay loam, 15 to 50 percent slopes; and 2 percent Soper gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is citrus, dryland barley, dryland pasture, and range. Capability unit IVe–1 (19); Loamy range site; Storie index 42.

Myford Series

The Myford series consists of moderately well drained soils on marine terraces. These soils formed in sandy sediments. Slopes are 0 to 30 percent. Elevation ranges from 50 to 1,500 feet. The vegetation generally is annual grasses and forbs and scattered low growing brush. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 270 to 350 days.

In a typical profile (fig. 2) the surface layer is pale brown and pinkish gray, medium acid sandy loam 4 inches thick. The subsurface layer is pinkish gray, medium acid sandy loam 8 inches thick. The upper 6 inches of the subsoil is brown, medium acid sandy clay; the next 17 inches is brown, neutral and moderately alkaline sandy clay loam; and the lower 36 inches is light brown, calcareous sandy clay loam and sandy loam. The substratum is very pale brown slightly acid sandy loam to a depth of 79 inches or more.

The soil is very slowly permeable.

Myford soils are used for citrus, pasture, range, barley, and urban development.

Typical profile of Myford sandy loam, 2 to 9 percent slopes, about ½ mile east of the junction of the San Diego and the Santa Ana Freeway, Irvine Ranch, Orange County, E¼E¼ sec. 172 (projected from a private survey as shown on U.S.G.S. El Toro Quadrangle, topographic map), T. 6 S., R. 8 W., SBB&M.

A11—0 to 1 inch; pale brown (10YR 6/3) sandy

Figure 2.—**Profile of Myford sandy loam, 2 to 9 percent slopes.**

loam, brown (10YR 4/3) moist; weak medium platy structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular pores; medium acid; abrupt smooth boundary.

A12—1 to 4 inches; pinkish gray (7.5YR 6/2) sandy loam, brown (7.5YR 4/2) moist; weak medium platy structure; hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; medium acid; clear smooth boundary.

A2—4 to 12 inches; pinkish gray (7.5YR 7/2) sandy loam, brown (7.5YR 4/2) moist; massive; hard, friable, nonsticky, nonplastic; common very fine roots; many very fine tubular pores; medium acid; abrupt smooth boundary.

B21t—12 to 18 inches; brown (7.5YR 4/2) sandy clay, dark brown (7.5YR 3/2) moist; strong very coarse prismatic structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; common moderately thick clay films on peds and in pores; medium acid; clear smooth boundary.

B22t—18 to 28 inches; brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate coarse prismatic structure parting to strong coarse angular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; common very fine pores; few thin clay films line the pores; neutral; clear smooth boundary.

B31tca—28 to 35 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; few thin clay films line the pores; violently effervescent; lime in small masses; moderately alkaline; clear smooth boundary.

B32tca—35 to 41 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, slightly sticky and plastic; very few very fine roots; common very fine pores; common moderately thick clay films on peds and line the pores; slightly effervescent; lime in filaments; moderately alkaline; diffuse smooth boundary.

B33t—41 to 49 inches; light brown (7.5YR 6/4) light sandy clay loam, brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, slightly sticky and plastic; very few very fine roots; common very fine pores; common moderately thick clay films on peds and line the pores; moderately alkaline; diffuse smooth boundary.

B34t—49 to 61 inches; light brown (7.5YR 6/4) light sandy loam, brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, slightly sticky and plastic; very few very fine roots; many very fine pores; common moderately thick clay films on peds and line the pores; slightly acid; diffuse smooth boundary.

B35t—61 to 71 inches; light brown (7.5YR 6/4) light sandy clay loam, brown (7.5YR 4/2) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, firm, slightly sticky and plastic; very few very fine roots; many very fine pores; common moderately thick clay films on peds and line the pores; slightly acid; clear wavy boundary.

C—71 to 79 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine pores; slightly acid.

The A horizon ranges from light brownish gray to pale brown or grayish brown to brown in 10YR hue and pinkish gray in 7.5YR hue. The A2 horizon is one value lighter than the A1 horizon. Texture is sandy loam or loam. In places the surface area is 5 percent pebbles or 1 percent cobbles, or both. Structure typically ranges from weak subangular blocky to weak platy. In places the A1 horizon is massive. Reaction ranges from medium acid to strongly acid. Thickness ranges from 5 to 30 inches.

The B2t horizon ranges from brown or light brown to yellowish brown in 7.5YR and 10YR hue. Texture is sandy clay or heavy clay loam in the upper part and sandy clay loam or clay loam in the lower part.

The water table is intermittently perched above the B2t horizon during some wet periods.

172—Myford sandy loam, 0 to 2 percent slopes. This nearly level soil generally occurs on broad terraces.

About 10 percent of this mapping unit is included areas of Myford sandy loam, thick surface, 0 to 2 percent slopes; 3 percent Capistrano sandy loam; 3 percent Chesterton loamy sand; 3 percent Yorba gravelly sandy loam; and 5 percent steeper Myford soils. Also included were areas where sheet erosion has been moderate.

If the soil is bare, runoff is slow and the erosion hazard is moderate. Available water capacity is 2.0 to 4.0 inches. The effective rooting depth is 12 to 19 inches for root-sensitive crops. For other crops it is 60 inches or more.

Present land use is citrus, pasture, range, barley, and urban development. Capability unit IVe–3 (19); Claypan range site; Storie index 51.

173—Myford sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on broad terraces. The profile of this soil is described as typical of the series.

About 10 percent of this mapping unit is included areas of Myford sandy loam, thick surface, 2 to 9 percent slopes; 3 percent Capistrano sandy loam; 3 percent Chesterton loamy sand, 2 to 15 percent slopes; 5 percent Yorba gravelly sandy loam, 2 to 9 percent slopes; and 7 percent steeper or gently sloping Myford soils. Also included were a few shallow gullies and areas affected by moderate sheet erosion.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 2.0 to 4.0 inches. The effective rooting depth is 60 inches or more.

Present land use is citrus, pasture, range, barley, and urban development. Capability unit IVe–3 (19); Claypan range site; Storie index 46.

174—Myford sandy loam, 2 to 9 percent slopes, eroded. This gently sloping to moderately sloping soil generally occurs on broad terraces. The profile is similar to the one described as typical of the series, but it is very shallow because of erosion. On about half the acreage, the subsoil is exposed or deep gullies have formed that prevent tillage.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 2 to 9 percent slopes; 3 percent Yorba gravelly sandy loam; and 5 percent less sloping or steeper Myford soils.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 1.5 to 3.5 inches. The effective rooting depth is 5 to 12 inches for root sensitive crops. For other crops it is 60 inches or more.

Present land use is range, barley, and urban development. Capability unit VIe–1 (19); Claypan range site; Storie index 19.

175—Myford sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on side slopes of terraces.

About 5 percent of this mapping unit is included areas of Myford sandy loam, eroded; 3 percent Capistrano sandy loam; 3 percent Yorba gravelly sandy loam, 9 to 15 percent slopes; less than 2 percent San Andreas sandy loam; and 5 percent less sloping or steeper Myford soils. Also included are a few shallow gullies and areas where sheet erosion has been moderate.

If the soil is bare, runoff is medium to rapid and the erosion hazard is moderate to high. Available water capacity is 2.0 to 4.0 inches. The effective rooting depth is 12 to 19 inches for root-sensitive crops. For other crops it is 60 inches or more.

Present land use is pasture, range, barley, and urban development. Capability unit IVe–3 (19); Claypan range site; Storie index 35.

176—Myford sandy loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on side slopes of terraces.

About 5 percent of this mapping unit is included areas of Myford sandy loam, eroded; 3 percent Yorba gravelly sandy loam, 15 to 30 percent slopes; 3 percent Cieneba sandy loam, 15 to 30 percent slopes; and 5 percent less sloping or steeper Myford soils. Also included are a few shallow gullies and areas where sheet erosion has been moderate.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 2.0 to 4.0 inches. The effective rooting depth is 12 to 19 inches for root sensitive crops. For other crops it is 60 inches or more.

Present land use is range, barley, and urban development. Capability unit VIe–1 (19); Claypan range site; Storie index 27.

177—Myford sandy loam, 9 to 30 percent slopes, eroded. This strongly sloping to moderately steep soil generally occurs on side slopes of terraces. The profile is similar to the one described as typical of the series, but is very shallow because of erosion. On as much as 50 percent of the acreage, the subsoil is exposed or deep gullies have formed that prevent tillage.

About 10 percent of this mapping unit is included areas of Myford sandy loam; 3 percent Yorba cobbly sandy loam, 9 to 30 percent slopes, eroded; and 4 percent Cieneba sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 1.5 to 3.5 inches. The effective rooting depth is 5 to 12 inches for root-sensitive crops. For other crops it is 60 inches or more.

Present land use is range, watershed, wildlife, and

urban development. Capability unit VIIe–1 (19); Claypan range site; Storie index 14.

178—Myford sandy loam, thick surface, 0 to 2 percent slopes. This nearly level soil generally occurs on broad terraces. The profile is similar to the one described as typical of the series, but the surface layer is about 10 inches thicker.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 0 to 2 percent slopes; 3 percent Capistrano sandy loam; 3 percent Chesterton loamy sand; 3 percent Yorba gravelly sandy loam; and 5 percent steeper sloping Myford soils.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 3.0 to 5.5 inches. The effective rooting depth is 20 to 30 inches for root-sensitive crops. For other crops it is 60 inches or more.

Present land use is citrus, pasture, range, barley, and urban development. Capability unit IIIs–3 (19); Claypan range site; Storie index 60.

179—Myford sandy loam, thick surface, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on broad terraces. The profile is similar to the one described as typical of the series, but the surface layer is about 10 inches thicker.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 2 to 9 percent slopes; 3 percent Capistrano sandy loam; 3 percent Chesterton loamy sand, 2 to 9 percent slopes; 3 percent Yorba gravelly sandy loam, 2 to 9 percent slopes; and 7 percent steeper or more gently sloping Myford soils.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 3.0 to 5.5 inches. The effective rooting depth is 20 to 30 inches for root-sensitive crops. For other crops it is 60 inches or more.

Present land use is citrus, pasture, range, barley, and urban development. Capability unit IIIe–3 (19); Claypan range site; Storie index 54.

Nacimiento Series

The Nacimiento series consists of well drained soils on foothills. These soils formed in material weathered from soft sandstone or shale, or both. Slopes are 15 to 50 percent. Elevation ranges from 100 to 2,500 feet. The vegetation is sagebrush and in some areas an undercover of annual grasses. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 300 to 350 days.

In a typical profile the surface layer is brown clay loam 28 inches thick. The underlying material is light yellowish brown and very pale brown shale or sandstone, or both.

The soil is moderately alkaline and calcareous throughout. Permeability is moderately slow. The effective rooting depth is 24 to 36 inches. Available water capacity is 4.0 to 7.0 inches.

Nacimiento soils are used for pasture, range, and watershed.

Typical profile of Nacimiento clay loam, 30 to 50 percent slopes, in Chino Hills, near a truck trail on a hill ridge, about 400 feet east of a power pole and about 1,000 feet north of Blue Mud Canyon, Rancho Santa Ana, Orange County, SW¼NW¼ sec. 20 (projected); T. 3 S., R. 8 W., SBB&M.

A11—0 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots; many fine and medium tubular pores; strongly effervescent; disseminated lime; moderately alkaline; clear smooth boundary.

A12ca—14 to 28 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots; strongly effervescent; disseminated lime and in filaments; moderately alkaline; clear wavy boundary.

Cr—28 to 40 inches; light yellowish brown (10YR 6/4) and very pale brown (10YR 7/3) weathered shale and sandstone, yellowish brown (10YR 5/4) and pale brown (10YR 6/3) moist; roots along some fractures; lime coats rock fragments which are calcareous throughout.

The A horizon ranges from brown to dark grayish brown in 10YR or 2.5Y hue. Texture is loam or clay loam. Thickness ranges from 24 to 36 inches. In places vertical cracks up to ¼ inch wide occur to a depth of 20 inches or more. This horizon is mildly alkaline to moderately alkaline and calcareous.

The Cr horizon ranges from light yellowish brown, light olive brown, very pale brown, light brownish gray to pale yellow in 10YR or 2.5Y hue. It is moderately alkaline and calcareous in some parts.

180—Nacimiento clay loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on hillsides.

About 10 percent of this mapping unit is included areas of Anaheim clay loam, 5 percent Alo clay, 2 percent Anaheim loam, 2 percent Cieneba sandy loam, and 2 percent Balcom clay loam.

If the soil is bare, runoff is medium to rapid and the erosion hazard is moderate to high.

Present land use is pasture, range, and watershed. Capability unit IVe–1 (19); Clayey range site; Storie index 39.

181—Nacimiento clay loam, 30 to 50 percent slopes. This steep soil generally occurs on hillsides. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Anaheim clay loam, 5 percent Alo clay, 2 percent Anaheim loam, 2 percent Cieneba sandy loam, and 2 percent Balcom clay loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is range and watershed. Capability unit VIe–1 (19); Clayey range site; Storie index 21.

Omni Series

The Omni series consists of poorly drained soils on flood plains and in basins. These soils formed in mixed alluvium. Slopes are 0 to 2 percent. Elevation ranges from 25 to 150 feet. The vegetation is annual grasses,

mustard, and plants that require moisture. Precipitation is 12 to 14 inches, and the mean annual air temperature is about 61°F. The frost-free season is 280 to 300 days.

In a typical profile the surface layer is gray clay 17 inches thick. The subsoil is light gray clay, with prominent olive brown mottles, 33 inches thick. Below this is a buried dark gray, mottled clay that extends to a depth of 60 inches or more.

The soil is moderately alkaline and calcareous throughout. It is slowly permeable.

Omni soils are used for row crops, field crops, and urban development.

Typical profile of Omni clay, in Orange County, Costa Mesa area, about 200 yards south of Sunflower Avenue, about 200 yards east of Bristol Street, and about 20 feet east of the Santa Ana Channel (flood control channel), T. 5 S., R. 10 W., SBB&M.

Ap—0 to 9 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate very coarse prismatic structure, upper ½ inch is strong medium granular structure; very hard, firm, sticky and plastic; common very fine roots; very few very fine tubular pores; strongly effervescent; disseminated lime; moderately alkaline; clear smooth boundary.

A12—9 to 17 inches; gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and plastic; very few very fine roots; very few very fine tubular pores; strongly effervescent; disseminated lime; moderately alkaline; clear smooth boundary.

B21cag—17 to 31 inches; light gray (10YR 6/1) clay, dark gray (10YR 4/1) moist, many medium prominent olive brown (2.5Y 4/4) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; very few very fine roots; many very fine tubular pores; strongly effervescent; disseminated lime and medium lime concretions; moderately alkaline; gradual smooth boundary.

B22cag—31 to 50 inches; light gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; many medium prominent olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; very hard, firm, sticky and plastic; many very fine tubular pores; strongly effervescent; disseminated lime and medium lime concretions; moderately alkaline; gradual smooth boundary.

A1b—50 to 60 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common fine prominent olive brown (2.5Y 4/4) mottles; massive; very hard, firm, sticky and plastic; common very fine tubular pores; strongly effervescent; disseminated lime and medium soft lime masses; moderately alkaline.

The A horizon ranges from very dark gray to gray in 10YR hue; a very thin film of gray (10YR 5/1) particles coats some of the darker surface peds. Texture is silt loam or clay. The upper one-half inch of this horizon generally has granular or fine blocky structure; the rest has weak to strong coarse or very coarse prismatic structure or weak to moderate coarse angular or subangular blocky structure. Reaction ranges from moderately alkaline to strongly alkaline. Thickness ranges from 12 to 20 inches.

The B horizon may be light gray, dark gray, very dark grayish brown, dark grayish brown, or grayish brown in 10YR hue. Part or all of this horizon has distinct or prominent mottles. Texture is heavy silty clay loam or clay. Reaction ranges from moderately alkaline to strongly alkaline.

In places there is a C horizon within 60 inches of the surface. A buried A horizon is common.

In undrained areas the water table is within a depth of 36 inches. Most areas now have altered drainage, however, and the water table is below 5 feet. Under natural conditions, most areas of this soil are moderately saline-alkali. Some are strongly saline-alkali. If drainage has been altered, the soil is generally no more than slightly saline-alkali.

182—Omni silt loam, drained. The profile of this nearly level soil is similar to the one described as typical of the series, but the surface layer is silt loam 10 to 14 inches thick.

About 7 percent of this mapping unit is included areas of Chino silty clay loam and 5 percent Bolsa silt loam.

The effective rooting depth is 60 inches or more. Available water capacity is 8.5 to 12.0 inches. Runoff is very slow, and the erosion hazard is none to slight.

Present land use is row crops, field crops, and urban development. Capability unit IIs–3 (19); range site not assigned; Storie index 50.

183—Omni clay. The profile of this nearly level soil is similar to the one described as typical of the series, but the water table is within a depth of 42 inches and the surface layer is strongly alkaline to moderately saline-alkali.

About 5 percent of this mapping unit is included areas of Chino silty clay loam and 5 percent Bolsa silty clay loam.

Runoff is very slow, and the erosion hazard is none to slight. The effective rooting depth is 40 to 60 inches. Available water capacity is 8.5 to 12.0 inches.

Present land use is field crops, duck ponds, and urban development. The high shrink-swell characteristics of this soil are problems in urban development. Capability unit IIIw–6 (19); range site not assigned; Storie index 17.

184—Omni clay, drained. This nearly level soil generally occurs in basins. It has the profile described as typical of the series. Because altered drainage has lowered the water table to a depth of 60 inches or more, some of the excess salts has been leached from the root zone, and the soil is generally only slightly saline-alkali.

About 5 percent of this mapping unit is included areas of Chino silty clay loam, drained; 3 percent Bolsa silty clay loam, drained; and 3 percent Cropley clay.

If the soil is bare, runoff is very slow and the erosion hazard is slight. The effective rooting depth is 60

inches or more. Available water capacity is 8.5 to 12.0 inches.

Present land use is irrigated row crops, field crops, and urban development. The high shrink-swell characteristics of this clay soil are problems in urban development. Capability unit IIs–5 (19); range site not assigned; Storie index 25.

Pits

185—Pits are open excavations from which soil and underlying material, mostly sand and gravel, have been removed for construction.

Present land use is construction material, idle land, or ground water recharge if these areas are in a streambed. Capability unit VIIIs–1 (19); range site not assigned; Storie index less than 10 (nonagricultural).

Ramona Series

The Ramona series consists of well drained soils on terraces and alluvial fans. These soils formed in granitic alluvium. Slopes are 2 to 15 percent. Elevation ranges from 1,000 to 3,000 feet. The vegetation is mostly brush and an understory of grasses. Precipitation is 16 to 20 inches, and the mean annual air temperature is about 60°F. The frost-free season is 240 to 320 days.

In a typical profile the surface layer is brown, slightly acid fine sand loam 8 inches thick. The subsoil is brown, slightly acid sandy clay loam 44 inches thick. The substratum is brown, neutral fine sandy loam to a depth of 69 inches or more.

The soil has moderately slow permeability. The effective rooting depth is 60 inches or more.

Ramona soils are used for range, watershed, and wildlife habitat.

Typical profile of Ramona fine sandy loam, 2 to 9 percent slopes, in the Cleveland National Forest, NE¼-SW¼ sec. 5 (projected), T. 7 S., R. 5 W., Riverside County, 1,000 feet south of Pigeon Spring on the Verdugo Truck Trail:

A11—0 to 2 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium, fine and very fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine tubular pores; slightly acid; abrupt smooth boundary.

A12—2 to 8 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; slightly acid; clear smooth boundary.

B21t—8 to 26 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; common very fine and few fine medium and coarse roots; common very fine tubular pores; common thin clay films lining pores and as bridges holding coarser particles; slightly acid; gradual smooth boundary.

B22t—26 to 41 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate coarse angular blocky structure; very hard, firm, sticky and plastic; very few very fine and coarse roots; common very fine tubular pores; many thick clay films on peds; slightly acid; gradual smooth boundary.

B3t—41 to 52 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate medium angular blocky structure; very hard, firm, sticky and slightly plastic; few very fine roots; common thin clay films on peds; slightly acid; clear smooth boundary.

C—52 to 69 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and medium roots in upper 10 inches; neutral.

The A horizon ranges from grayish brown to brown in 10YR and 7.5YR hue. Texture is coarse sandy loam, sandy loam, or fine sandy loam and in places is gravelly. Reaction ranges from slightly acid to neutral. Thickness ranges from 7 to 14 inches.

The Bt horizon ranges from brown to dark brown or yellowish brown in 10YR and 7.5YR hue. Texture is loam or sandy clay loam. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 30 to 40 inches.

The C horizon is granitic alluvium of sandy loam or fine sandy loam texture. It extends to a depth of 60 inches or more.

186—Ramona fine sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs as long, narrow areas 5 to 50 acres in size. It has the profile described as typical of the series.

About 6 percent of this mapping unit is included areas of Blasingame loam; 3 percent soils that have a sandy loam subsoil but are otherwise similar to this Ramona soil; 3 percent Hanford sandy loam; and 3 percent Capistrano sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 8 to 10 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit IIIe–1 (19); Loamy range site; Storie index 76.

187—Ramona gravelly fine sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs as fan-shaped areas of 5 to 50 acres. The profile is similar to the one described as typical of the series, but the surface layer is gravelly fine sandy loam.

About 6 percent of this mapping unit is included areas of Blasingame loam; 3 percent soils that have a sandy loam subsoil but are otherwise similar to this Ramona soil; 3 percent Garretson gravelly very fine sandy loam; 3 percent Capistrano sandy loam; and 3 percent areas of Ramona gravelly fine sandy loam where slopes are 15 to 30 percent.

If the soil is bare, runoff is medium and the erosion hazard is high. Available water capacity is 6.0 to 9.0 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit IVe–1 (19); Loamy range site; Storie index 59.

Rincon Series

The Rincon series consists of well drained soils on terraces. These soils formed in semiconsolidated alluvium derived from sedimentary rocks. Slopes are 2 to 30 percent. Elevation ranges from 100 to 1,000 feet. The vegetation is annual grasses and forbs. Precipitation is 12 to 18 inches, and the mean annual air temperature is about 62°F. The frost-free season is 270 to 300 days.

In a typical profile the surface layer is dark grayish brown clay loam 11 inches thick. The subsoil is brown and yellowish brown heavy clay loam and loam 24 inches thick. The substratum is light yellowish brown loam that extends to a depth of 60 inches or more.

The soil is slightly acid in the upper 4 inches and moderately alkaline below. Lime occurs in the lower part of the subsoil and substratum. Permeability is slow. The effective rooting depth is 60 inches or more. Available water capacity is 9.0 to 11.0 inches.

Rincon soils are used for citrus, barley, range, and urban development.

Typical profile of Rincon clay loam, 2 to 9 percent slopes, in Brea, SE¼SW¼ sec. 7, T. 3 S., R. 9 W., Orange County, about 200 feet north and 20 feet west of the northwest corner of Kreamer and Birch:

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, firm, sticky and plastic; common very fine roots; many fine tubular pores; slightly acid; clear smooth boundary.

A12—4 to 11 inches; dark grayish brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; massive; hard, firm, sticky and plastic; common very fine roots; few fine tubular pores; moderately alkaline; clear smooth boundary.

B21t—11 to 23 inches; brown (10YR 4/3) heavy clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; common very fine roots; few fine tubular pores; common thin clay films on peds; moderately alkaline; clear wavy boundary.

B22t—23 to 28 inches; yellowish brown (10YR 5/4) heavy clay loam, dark yellowish brown (10YR 4/4) moist; strong medium and coarse angular blocky structure; very hard, firm, sticky and plastic; few very fine roots; very few very fine tubular pores; common thin clay films on peds; moderately alkaline; abrupt smooth boundary.

B3tca—28 to 35 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; very few very fine tubular pores; few thin clay films on peds; strongly effervescent; lime in fine filaments and in seams; moderately alkaline; clear wavy boundary.

C—35 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; very few very fine roots; very few very fine pores; slightly effervescent; lime in filaments in upper 12 inches; moderately alkaline.

The A horizon ranges from dark grayish brown to grayish brown in 10YR hue. Texture is loam, sandy clay loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline. Thickness ranges from 6 to 14 inches.

The B2t horizon ranges from grayish brown and dark grayish brown to brown or yellowish brown in 10YR hue. Texture is heavy clay loam or clay. Reaction ranges from neutral to moderately alkaline. Thickness ranges from 16 to 20 inches.

The C horizon ranges from light gray or pale brown to light yellowish brown in 10YR hue. In many places it is stratified. Texture ranges from sandy loam to clay loam or loam. Reaction ranges from mildly alkaline to moderately alkaline. The soil is calcareous in some parts.

In places gravel occurs throughout the profile.

188—Rincon clay loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on broad terraces. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Alo clay, and 3 percent Yorba gravelly sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is citrus, barley, pasture, range, and urban development. Capability unit IIe–3 (19); Clayey range site; Storie index 65.

189—Rincon clay loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on terraces.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Alo clay, and 2 percent Yorba gravelly sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate.

Present land use is citrus, range, watershed, wildlife habitat, and urban development. Capability unit IIIe–3 (19); Clayey range site; Storie index 61.

190—Rincon clay loam, 15 to 30 percent slopes. This moderately steep soil generally occurs as long, narrow areas of 5 to 75 acres along drainageways.

About 10 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Alo clay, and 2 percent Yorba gravelly sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is citrus, pasture, range, and urban

development. Capability unit IVe–3 (19); Clayey range site; Storie index 47.

Riverwash

191—Riverwash consists of areas of unconsolidated alluvium, generally stratified and varying widely in texture, recently deposited by intermittent streams, and subject to frequent changes through stream overflow. These are sandy, gravelly, cobbly, and bouldery deposits that support little or no vegetation.

Runoff is generally rapid, and the erosion hazard is high. Deposition and removal of fresh alluvium are common.

Riverwash has little or no agricultural value. Present use is watercourses, ground water recharge, sand and gravel pits, and wildlife habitat. Capability unit VIIIw–1 (19); range site not assigned; Storie index 40 (nonagricultural).

Rock Outcrop

Rock outcrop consists of large exposures of sandstone or granite and boulders.

192—Rock outcrop-Cieneba complex, 30 to 75 percent slopes. This mapping unit is in mountains or on foothills. It is 50 percent or more Rock outcrop and boulders and 50 percent or less Cieneba soils. The soils are somewhat excessively drained. They formed in material weathered from granitic or sandstone rock. Elevation ranges from 200 to 4,500 feet. The vegetation is mainly sparse brush. Precipitation is 14 to 25 inches, and the mean average air temperature is 59 to 62°F. The frost-free season is 200 to 350 days.

About 5 percent of this mapping unit is included areas of Vista-Rock outcrop complex, 3 percent Tollhouse-Rock outcrop complex in the Santa Ana Mountains, 3 percent Anaheim loam, and 3 percent Soper cobbly loam in the coastal foothills.

If the soil is bare, runoff is rapid and the erosion hazard is high. Permeability is moderately rapid. Available water capacity is 0.8 to 2.5 inches. The effective rooting depth is 5 to 15 inches.

Present land use is watershed, wildlife habitat, and, to a limited extent, range. Capability unit VIIs–1 (19); Shallow Loamy-Rock outcrop complex range site; Storie index 4.

San Andreas Series

The San Andreas series consists of well drained soils on foothills. These soils formed in material weathered from soft sandstone. Slopes are 15 to 30 percent. Elevation ranges from 200 to 2,500 feet. The vegetation is mainly brush and an understory of grasses. Precipitation is 14 to 20 inches, and the mean annual air temperature is about 61°F. The frost-free season is 270 to 350 days.

In a typical profile the surface layer is dark grayish brown, medium acid and slightly acid sandy loam 31 inches thick. The underlying material is soft sandstone to a depth of 50 inches.

The soil has moderately rapid permeability. Available water capacity is 2.5 to 5.5 inches. The effective rooting depth is 24 to 32 inches

San Andreas soils are used for citrus, barley, pasture, range, watershed, and wildlife habitat.

Typical profile of San Andreas sandy loam, 15 to 30 percent slopes, about 1 mile southwest of Limestone Canyon, Irvine Ranch, Orange County, NE¼SW¼ sec. 117 (by private survey), T. 5 S., R. 8 W., SBB&M.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak very thick platy structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; medium acid; abrupt smooth boundary.

A12—4 to 15 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; medium acid; clear smooth boundary.

A13—15 to 31 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; common very fine, few fine tubular pores; slightly acid; abrupt wavy boundary.

Cr—31 to 50 inches; soft sandstone.

The A horizon ranges from grayish brown or brown to dark grayish brown in 10YR hue. Texture is loamy fine sand, sandy loam, or fine sandy loam. Structure ranges from granular or weak subangular blocky to platy. In places the soil is massive. Thickness ranges from 24 to 32 inches.

The Cr horizon ranges from soft to brittle sandstone that can easily be cut by hand tools. It is generally massive.

193—San Andreas sandy loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on north- and east-facing hillsides. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Cieneba sandy loam, 3 percent Anaheim loam, 3 percent Myford sandy loam, 2 percent Capistrano sandy loam, and 10 percent less sloping or steeper San Andreas sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

Present land use is citrus, dryfarmed barley, dryland pasture, range, watershed, and wildlife habitat. Capability unit VIe–1 (19); Loamy range site; Storie index 41.

San Emigdio Series

The San Emigdio series consists of well drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slopes are 0 to 9 percent. Elevation is 10 to 700 feet. The vegetation is annual grasses and forbs. Precipitation is 12 to 18 inches, and the mean annual air temperature is about 62°F. The average frost-free season is 270 to 350 days

In a typical profile the surface layer is light brownish gray fine sandy loam 7 inches thick. The underlying

material to a depth of 61 inches or more is very pale brown, pale brown, light brownish gray, and light gray, stratified fine sandy loam, sandy loam, very fine sandy loam, and gravelly loamy coarse sand.

The soil is moderately alkaline and calcareous throughout. It is moderately rapidly permeable. The effective rooting depth is more than 60 inches.

These soils are used for citrus, row crops, field crops, and urban development.

Typical profile of San Emigdio fine sandy loam, 0 to 2 percent slopes, in Orange County on the Irvine Ranch, NW¼NW¼ sec. 142 (by private survey), T. 5 S., R. 8 W., SBB&M.

Ap—0 to 7 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few fine roots; very few fine tubular pores and many fine interstitial pores; 25 percent ⅛- to 3-inch rounded and angular pebbles on surface; slightly effervescent; moderately alkaline; abrupt smooth boundary.

C1—7 to 21 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine, fine, and medium roots; very few medium and few fine and common very fine tubular pores; violently effervescent; moderately alkaline; clear wavy boundary.

IIC2—21 to 26 inches; light gray (10YR 7/2) gravelly loamy coarse sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; very few very fine, fine, and medium roots; few fine tubular pores and many interstitial pores; 15 percent pebbles and a few cobbles; slightly effervescent; moderately alkaline; abrupt smooth boundary.

IIIC3—26 to 34 inches; light gray (10YR 7/2) very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; very few fine and medium roots; few fine and medium tubular pores and many very fine and fine interstitial pores; violently effervescent; moderately alkaline; abrupt smooth boundary.

IIIC4—34 to 43 inches; light gray (10YR 7/2) coarse sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; very few fine and and few very fine roots; few very fine and fine tubular pores and many medium interstitial pores; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIIC5—43 to 54 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, friable, nonsticky and nonplastic; very few fine and few fine roots; common very fine tubular pores; 1 percent by volume 1-inch pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

IIIC6—54 to 61 inches; light brownish gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; very few very fine tubular pores and many medium interstitial pores; 25 percent by volume pebbles mostly 2 inches and larger; violently effervescent; moderately alkaline.

Color of the A horizon ranges from light brownish gray to pale brown in 10YR hue. Texture is sandy loam or fine sandy loam. Thickness ranges from 6 to 10 inches.

Color of the C horizon ranges from light gray, light brownish gray, pale brown, and very pale brown to grayish brown in 10YR hue. Texture is variable because of stratification and ranges from gravelly loamy coarse sand to very fine sandy loam.

In places the surface area is 2 to 3 percent pebbles. In other places the profile is 2 to 3 percent pebbles.

194—San Emigdio fine sandy loam, 0 to 2 percent slopes. This nearly level soil generally occupies alluvial fans on flood plains and along stream channels. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Metz loamy sand, 5 percent Hueneme fine sandy loam, 3 percent Mocho sandy loam, and 2 percent Soboba gravelly loam sand.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 7.0 to 9.0 inches.

This soil is used for citrus, row crops, field crops, and urban development. Capability unit I (19) ; Loamy range site; Storie index 95.

195—San Emigdio fine sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on alluvial fans along stream channels.

About 5 percent of the mapping unit is included areas of Sorrento sandy loam, 3 percent Mocho loam, and 5 percent Capistrano sandy loam.

If the soil is bare, runoff is slow and the erosion hazard is slight to moderate. Available water capacity is 7.0 to 9.0 inches.

This soil is used for citrus, row crops, and urban development. Capability unit IIe–1 (19) ; Loamy range site; Storie index 85.

196—San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes. This nearly level soil is generally on alluvial fans on flood plains and along stream channels. It has a profile similar to the one described as typical of the series, but a layer of dark gray silty clay loam or silt loam occurs 40 to 60 inches below the surface. This layer is 2 to 6 inches thick.

About 5 percent of this mapping unit is included areas of Metz loamy sand, 5 percent Hueneme fine sandy loam, and 2 percent Sorrento sandy loam.

Permeability is moderately slow in the underlying material. The water table is intermittently perched just above the underlying material. Available water capacity is 7.0 to 10.0 inches. Runoff is slow, and the erosion hazard is slight.

This soil is used for row crops, field crops, and urban

development. Capability unit I (19) ; Loamy range site; Storie index 81.

Soboba Series

The Soboba series consists of excessively drained soils on flood plains and alluvial fans. These soils formed in mixed alluvium. Slopes are 0 to 15 percent. Elevation ranges from 50 to 2,500 feet. The vegetation is annual grasses, forbs, cactus, brush, and some trees. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62°F. The frost-free season is 250 to 300 days.

In a typical profile the surface layer is light brownish gray and pale brown gravelly loamy sand to a depth of 10 inches. The underlying material is light gray very gravelly sand to a depth of 60 inches or more. Thin intermittent bands of sandy loam occur between depths of 12 and 30 inches.

The soil is slightly acid throughout. It is very rapidly permeable. The effective rooting depth is 60 inches or more. Available water capacity is 2.0 to 3.0 inches.

Soboba soils are used for citrus, pasture, range, and wildlife habitat.

Typical profile of Soboba gravelly loam, 0 to 5 percent slopes, in Orange County, Rancho Mission Viejo, about 1,100 feet north-northwest of point where Riverside, San Diego, and Orange county lines meet, in La Paz Canyon, SW¼SE¼ sec. 33, T. 7 S., R. 6 W., SBB&M.

A1—0 to 10 inches; light brownish gray (10YR 6/2) and pale brown (10YR 6/3) gravelly loamy sand, dark grayish brown (10YR 4/2) and brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; common very fine roots; many fine, medium and coarse interstitial pores; 25 percent pebbles and 5 percent cobbles; slightly acid; clear wavy boundary.

C1—10 to 40 inches; light gray (10YR 7/2), light brownish gray (10YR 6/2) and pale brown (10YR 6/3) very gravelly sand, dark grayish brown (10YR 4/2) and brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; few very fine, common medium roots; many fine, medium and coarse interstitial pores; two thin intermittent bands of sandy loam occur at about 12 and 30 inches; 50 percent pebbles and 10 percent cobbles; slightly acid; diffuse wavy boundary.

C2—40 to 60 inches; light gray (10YR 7/2), light brownish gray (10YR 6/2), and pale brown (10YR 6/3) very gravelly sand, dark grayish brown (10YR 4/2) and brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; few very fine and medium roots; many fine, medium and coarse interstitial pores; 40 percent pebbles and 20 percent cobbles; slightly acid.

The A1 horizon ranges from light brownish gray to pale brown to brown in 10YR and 2.5Y hue. Texture ranges from gravelly to cobbly sand to very fine sandy loam or gravelly loamy sand. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 0 to 15 inches.

The C horizon ranges from light gray and light brownish gray to gray and from grayish brown or pale brown to brown in 10YR or 2.5Y hue. This horizon is stratified. It is 35 to 60 percent pebbles and cobbles. Texture ranges from very gravelly or very cobbly sand to coarse sandy loam. Reaction ranges from slightly acid to mildly alkaline.

197—Soboba gravelly loamy sand, 0 to 5 percent slopes. This nearly level to gently sloping soil generally occurs as long, narrow areas along stream channels. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of a soil that is dominantly very gravelly sandy loam throughout but is otherwise similar to this Soboba soil; 5 percent Corralitos loamy sand; 7 percent Riverwash; and 5 percent Soboba soils that have a gravelly very fine sandy loam overwash.

If the soil is bare, runoff is slow and the erosion hazard is slight.

Present land use is citrus, pasture, range, and wildlife habitat. Capability unit VIs–1 (19) ; Sandy range site; Storie index 30.

198—Soboba cobbly loamy sand, 0 to 15 percent slopes. This nearly level to strongly sloping soil generally occurs as long, narrow areas along stream channels. The profile is similar to the one described as typical of the series, but the surface layer is cobbly loamy sand.

About 10 percent of this mapping unit is included areas of a soil that is dominantly very gravelly sandy loam throughout but is otherwise similar to this Soboba soil; 5 percent Corralitos loamy sand; 5 percent Riverwash; 5 percent steeper Soboba soils; and 10 percent Soboba soils that have a stony loamy sand surface layer.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate.

Present land use is pasture, range, and wildlife habitat. Capability unit VIs–1 (19) ; Sandy range site; Storie index 29.

Soper Series

The Soper series consists of well drained soils on foothills. These soils formed in weakly consolidated sandstone and conglomerate. Slopes are 15 to 75 percent. Elevation is 200 to 2,500 feet. The vegetation is sage, cactus, and brush and in some areas an understory of annual grasses and forbs. Precipitation is 14 to 20 inches, and the mean annual air temperature is about 62°F. The average frost-free season is 270 to 350 days.

In a typical profile the surface layer is brown, slightly acid gravelly loam 8 inches thick. The subsoil is reddish brown and yellowish red, neutral gravelly clay loam and gravelly loam 21 inches thick. The underlying material is weathered conglomerate. The soil is moderately slowly permeable.

Soper soils are used for pasture, range, watershed, and wildlife habitat.

Typical profile of Soper gravelly loam, 30 to 50 per-

cent slopes, in Orange County, Irvine Ranch, about 100 yards north of the Highland canal, NE¼NE¼ sec. 82 (by private survey), T. 5 S., R 8 W., SBB&M.

A1—0 to 8 inches; brown (10YR 4/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; few fine and common very fine roots; common very fine tubular pores; 12 percent pebbles and cobbles; slightly acid; abrupt smooth boundary.

B21t—8 to 11 inches; reddish brown (5YR 4/4) gravelly clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; very few fine and common very fine roots; common very fine and very few fine tubular pores; common moderately thick clay films line pores and are on peds; 25 percent pebbles and cobbles; neutral; clear smooth boundary.

B22t—11 to 21 inches; reddish brown (5YR 4/4) gravelly clay loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine and very few fine roots; few very fine tubular pores; many moderately thick clay films line pores and are on peds; 30 percent pebbles and cobbles; neutral; clear smooth boundary.

B3t—21 to 29 inches; yellowish red (5YR 5/6) gravelly loam, yellowish red (5YR 4/6) moist; weak medium and coarse angular blocky structure; hard, firm, slightly sticky and plastic; very few fine roots; few very fine tubular pores; few moderately thick clay films line pores and are on peds; 30 percent pebbles and cobbles; neutral; clear wavy boundary.

Cr—29 to 62 inches; weathered weakly consolidated conglomerate; very few very fine roots; very few very fine tubular pores; few thin clay films on rocks in upper part.

Color of the A horizon ranges from grayish brown and brown to dark grayish brown in 10YR hue. The texture is sandy loam or loam and is gravelly or cobbly in some areas. Reaction is neutral to slightly acid. Thickness ranges from 8 to 12 inches.

Color of the B2t horizon ranges from brown to reddish brown in 10YR, 7.5YR, and 5YR hue. The texture is sandy clay loam or clay loam and is gravelly or cobbly in some areas. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 12 to 20 inches.

Color of the Cr horizon varies. It is typically very pale brown and reddish brown. This horizon is consolidated conglomerate and sandstone and a few pockets of shale.

199—Soper loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on rolling hills. It has a profile similar to the one described as typical of the series, but it is nongravelly and noncobbly throughout. It is also slightly deeper.

About 5 percent of this mapping unit is included areas of Anaheim loam, 5 percent Alo clay, 2 percent Balcom clay loam, 3 percent Cieneba sandy loam, and less sloping or steeper Soper loams.

If the soil is bare, runoff is medium and the erosion hazard is high. Available water capacity is 3.5 to 5.5 inches. The effective rooting depth is 24 to 36 inches.

Present land use is pasture, range, wildlife habitat, and watershed. Capability unit IVe–1 (19); Loamy range site; Storie index 45.

200—Soper loam, 30 to 50 percent slopes. This steep soil generally occurs on hillsides. It has a profile similar to the one described as typical of the series, but it is nongravelly and noncobbly throughout.

About 5 percent of this mapping unit is included areas of Alo clay, 30 to 50 percent slopes; 5 percent Anaheim loam, 30 to 50 percent slopes; 3 percent Cieneba sandy loam, 30 to 75 percent slopes; 10 percent low sloping or steeper Soper loams; and 10 percent severely eroded areas.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 20 to 32 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit VIe–1 (19); Loamy range site; Storie index 21.

201—Soper gravelly loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on rolling hills. It has a profile similar to the one described as typical of the series, but it is somewhat deeper.

About 3 percent of this mapping unit is included areas of Anaheim loam, 2 percent Anaheim clay loam, 3 percent Cieneba sandy loam, and 7 percent less sloping or steeper Soper gravelly loams.

If the soil is bare, runoff is medium and the erosion hazard is high. Available water capacity is 3.0 to 5.5 inches. The effective rooting depth is 24 to 36 inches.

Present land use is pasture, range, watershed, and wildlife habitat. Capability unit VIe–1 (19); Loamy range site; Storie index 36.

202—Soper gravelly loam, 30 to 50 percent slopes. This steep soil generally occurs on hillsides. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Yorba gravelly sandy loam, 2 percent Gabino gravelly clay loam, 5 percent Soper cobbly loam, 5 percent less sloping or steeper Soper gravelly loams, 2 percent Cieneba-Rock outcrop complex, and 2 percent Cieneba sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 20 to 32 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit VIIe–1 (19); Loamy range site; Storie index 17.

203—Soper cobbly loam, 15 to 50 percent slopes. This moderately steep to steep soil generally occurs on hillsides. It has a profile similar to the one described as typical of the series, but the surface layer is cobbly loam.

About 5 percent of this mapping unit is included areas of Yorba cobbly sandy loam, 3 percent Gabino gravelly clay loam, 5 percent Soper gravelly loam, 2 percent Cieneba-Rock outcrop complex, and 2 percent Cieneba sandy loam.

If the soil is bare, runoff is medium to rapid and the

erosion hazard is high. Available water capacity is 3.0 to 4.0 inches. The effective rooting depth is 20 to 32 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit VIIs–1 (19); Loamy range site; Storie index 18.

204—Soper-Rock outcrop complex, 30 to 75 percent slopes. This mapping unit commonly occurs on hillsides and ridges. It is 10 to 15 percent Rock outcrop. The Soper soil has a profile similar to the one described as typical of the series, but it is severely eroded and therefore shallower.

About 3 percent of this mapping unit is included areas of Anaheim loam, 5 percent Cieneba sandy loam, and 20 percent Soper cobbly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. Available water capacity is 2.5 to 3.5 inches. The effective rooting depth is 20 to 24 inches.

Present land use is range, watershed, and wildlife habitat. Capability unit VIIs–1 (19); Shallow Loamy-Rock outcrop complex range site; Storie index 7.

Sorrento Series

The Sorrento series consists of well drained soils on alluvial fans and flood plains. These soils formed in alluvium derived from sedimentary rocks. Slopes are 0 to 9 percent. Elevation ranges from 50 to 700 feet. The vegetation is annual grasses and forbs and some sycamore trees. Precipitation is 12 to 16 inches, and the annual air temperature is 59 to 62°F. The frost-free season is 270 to 355 days.

In a typical profile, the surface layer is grayish brown loam 12 inches thick. The underlying material is grayish brown, light brownish gray, and pale brown silty clay loam to a depth of 62 inches and light brownish gray sandy loam to a depth of 72 inches or more.

The soil is neutral in the upper 6 inches and becomes moderately alkaline and calcareous below. It is moderately permeable. The effective rooting depth is 60 inches or more.

Sorrento soils are used for irrigated crops, citrus, and urban development.

Typical profile of Sorrento loam, 0 to 2 percent slopes, about 500 feet northeast of the corner of Irvine Boulevard and the road to El Toro Marine Firing Range, SW¼SW¼ sec. 120 (by private survey), T. 5 S., R. 8 W., SBB&M.

Ap1—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; neutral; abrupt smooth boundary.

Ap2—6 to 12 inches; grayish brown (10YR 5/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; few very fine and fine tubular pores; mildly alkaline; clear wavy boundary.

C1—12 to 21 inches; grayish brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, slightly sticky and plastic; many very fine roots; few very fine tubular pores; moderately alkaline; clear wavy boundary.

C2—21 to 27 inches; grayish brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular pores; moderately alkaline; gradual wavy boundary.

C3—27 to 37 inches; grayish brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; common very fine and fine tubular pores; moderately alkaline; gradual wavy boundary.

C4ca—37 to 49 inches; light brownish gray (10YR 6/2) light silty clay loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; disseminated lime and common fine filaments and fine soft masses of lime; moderately alkaline; violently effervescent; abrupt wavy boundary.

C5ca—49 to 62 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate coarse subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; common fine filaments of lime; moderately alkaline; violently effervescent; abrupt smooth boundary.

IIC6—62 to 72 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; very few very fine roots; few fine tubular pores; moderately alkaline and violently effervescent.

The A horizon ranges from dark grayish brown or grayish brown to brown in 10YR hue. Texture is sandy loam, loam, or clay loam. Reaction ranges from slightly acid to moderately alkaline. In places the soil is noncalcareous. Thickness ranges from 10 to 20 inches.

The C horizon ranges from grayish brown to light yellowish brown in 10YR or 2.5Y hue. Texture is loam, silt loam, or silty clay loam. This horizon is calcareous, at least in some parts above 40 inches.

In places the surface area is 2 to 3 percent gravel. In other places the profile is 2 to 3 percent gravel.

205—Sorrento sandy loam, 0 to 2 percent slopes. This nearly level soil generally occurs on alluvial fans and flood plains. It has the profile similar to the one described as typical of the series, but the surface layer is 10 to 14 inches of sandy loam.

About 10 percent of this mapping unit is included areas of Sorrento loam, 0 to 2 percent slopes; 5 percent

Mocho sandy loam, 0 to 2 percent slopes; 5 percent San Emigdido fine sandy loam, 0 to 2 percent slopes; and 5 percent soils that are noncalcareous throughout but are otherwise similar to this Sorrento soil.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 10.0 to 13.0 inches.

Present land use is irrigated row crops, citrus, and urban development. Capability unit I (19); Loamy range site; Storie index 95.

206—Sorrento loam, 0 to 2 percent slopes. This nearly level soil generally occurs on alluvial fans and flood plains and in small valleys. It has the profile described as typical of the series.

About 10 percent of this mapping unit is included areas of Sorrento clay loam; 3 percent Sorrento sandy loam; 5 percent soils that are noncalcareous throughout but are otherwise similar to this Sorrento soil; 5 percent Mocho loam, 0 to 2 percent slopes; and 3 percent Bolsa silt loam, drained.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 10.0 to 13.0 inches.

Present land use is irrigated row crops, citrus, and urban development. Capability unit I (19); Loamy range site; Storie index 100.

207—Sorrento loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on upper valley fans and along stream channels.

About 10 percent of this mapping unit is included areas of Sorrento clay loam; 5 percent soils that are noncalcareous throughout but are otherwise similar to this Sorrento soil; 5 percent Mocho loam, 2 to 9 percent slopes; 3 percent Botella loam, 2 to 9 percent slopes; and 3 percent areas of Sorrento loam where the slopes are somewhat steeper than 9 percent.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate. Available water capacity is 10.0 to 13.0 inches.

Present land use is irrigated crops, citrus, range, and urban development. Capability unit IIe–1 (19); Loamy range site; Storie index 90.

208—Sorrento clay loam, 0 to 2 percent slopes. This nearly level soil generally occurs on alluvial fans and flood plains. It has a profile similar to the one described as typical of the series, but the surface layer is 10 to 14 inches of clay loam.

About 10 percent of this mapping unit is included areas of Sorrento loam, 0 to 2 percent slopes; 5 percent Mocho loam, 0 to 2 percent slopes; 3 percent Bolsa silty clay loam, drained; 3 percent Chino silty clay loam, drained; and 5 percent soils that are noncalcareous throughout but are otherwise similar to this Sorrento soil.

If the soil is bare, runoff is slow and the erosion hazard is slight. Available water capacity is 11.0 to 13.0 inches.

Present land use is irrigated crops, citrus, and urban development. Capability unit I (19); Clayey range site; Storie index 85.

209—Sorrento clay loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on upper valley fans and along stream channels in 10- to 100-acre areas. It has a profile similar to the one described as typical of the series, but the surface layer is 10 to 14 inches of clay loam.

About 10 percent of this mapping unit is included areas of Sorrento loam, 2 to 9 percent slopes; 5 percent soils that are noncalcareous throughout but are otherwise similar to this Sorrento soil; 5 percent Mocho loam, 2 to 9 percent slopes; 3 percent Botella clay loam, 2 to 9 percent slopes; and 3 percent areas of this Sorrento soil where slopes are somewhat steeper than 9 percent.

If the soil is bare, runoff is slow to medium and the erosion hazard is slight to moderate. Available water capacity is 11.0 to 13.0 inches.

Present land use is irrigated crops, citrus, and urban development. Capability unit IIe–1 (19); Clayey range site; Storie index 76.

Thapto-Histic Fluvaquents

Thapto-Histic Fluvaquents consists of poorly drained soils in coastal basins. These soils formed in mixed mineral alluvium and organic deposits. Slopes are 0 to 2 percent. Elevation ranges from 5 to 50 feet. The vegetation is saline-alkali tolerant grasses and forbs that require moisture. Precipitation is 10 to 14 inches, and the mean annual air temperature is about 62°F. The frost-free season is 300 to 350 days.

In a typical profile the surface layer is 9 inches of very dark gray clay loam and 12 inches of dark gray silty clay. The underlying layers are 35 inches of black peat and 12 inches or more of light gray silty clay loam with many fine distinct light yellowish brown mottles.

The soil is medium acid to strongly acid in the peat layers and moderately alkaline in the mineral layers. The 21- to 50-inch zone has some white salts. Permeability is slow. The effective rooting depth is only 24 to 40 inches because of the water table. Available water capacity is 6.0 to 10.0 inches.

These soils are used for row crops, field crops, and duck ponds.

Reference profile of Thapto-Histic Fluvaquents, in Orange County, Irvine Range, about ¼ mile southwest of Lane Road, NE¼NE¼ sec. 59 (by private survey), T. 6 S., R. 9 W., SBB&M.

Ap1—0 to 3 inches; very dark gray (2.5Y 3/0) clay loam, black (2.5Y 2/0) moist; moderate medium and fine granular structure; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; estimated 10 to 20 percent organic matter; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Ap2—3 to 9 inches; very dark gray (2.5Y 3/0) heavy clay loam, black (2.5Y 2/0) moist; moderate fine and medium granular structure; hard, firm, sticky and very plastic; common very fine and fine roots; few very fine and fine tubular pores; estimated 10 to 20 percent organic matter; slightly effervescent; moderately alkaline; clear wavy boundary.

A13—9 to 14 inches; dark gray (2.5Y 4/0) silty clay, black (2.5Y 2/0) moist; moderate fine and medium granular structure;

very hard, firm, sticky and very plastic; common very fine and few fine roots; few very fine and fine tubular pores; estimated 10 to 20 percent organic matter; slightly effervescent; moderately alkaline; clear smooth boundary.

A14—14 to 21 inches; dark gray (2.5Y 4/0) silty clay, black (2.5Y 2/0) moist; weak fine and medium granular structure; hard, firm, sticky and plastic; common very fine roots; few very fine tubular pores; estimated 10 to 20 percent organic matter; strongly effervescent; moderately alkaline; clear wavy boundary.

Oa1b—21 to 27 inches; black (2.5Y 2/0) rubbed and unrubbed sapric material, black (2.5Y 2/0) dry; 5 percent fibers, none rubbed; moderate fine granular structure; very hard, nonsticky and nonplastic; some white salts; medium acid; clear wavy boundary.

Oa2b—27 to 32 inches; black (2.5Y 2/0) rubbed and unrubbed sapric material, black (2.5Y 2/0) dry; 10 percent fibers, less than 5 percent rubbed; massive; very hard, nonsticky and nonplastic; some white salts; strongly acid; clear wavy boundary.

Oa3b—32 to 39 inches; black (10YR 2/1) rubbed and unrubbed sapric material, very dark brown (10YR 2/2) dry; 30 percent fibers, less than 10 percent rubbed; massive; extremely hard, nonsticky and nonplastic; some white salts; strongly acid; gradual smooth boundary.

Oa4b—39 to 50 inches; black (10YR 2/1) rubbed and unrubbed sapric material with many fine faint dark gray (10YR 4/1) unrubbed mottles; very dark gray (10YR 3/1) with many fine prominent gray (10YR 6/1) mottles dry; 30 percent fibers, less than 10 percent rubbed; massive; very hard, nonsticky and nonplastic; some white salts; strongly acid; clear wavy boundary.

Oa5b—50 to 56 inches; black (10YR 2/1) rubbed and unrubbed sapric material with many fine faint dark gray (10YR 4/1) mottles unrubbed, very dark brown (10YR 2/2) with many fine prominent gray (10YR 6/1) mottles dry; 40 percent fibers, less than 10 percent rubbed; massive; extremely hard, nonsticky and nonplastic; strongly acid; abrupt smooth boundary.

IIC—56 to 68 inches; light gray (10YR 7/1) silty clay loam with many fine distinct light yellowish brown (2.5Y 6/4) mottles, gray (10YR 5/1) with light olive brown (2.5Y 5/4) mottles moist; massive; slightly hard, firm, sticky and slightly plastic; 10 percent partly decomposed roots in upper 6 inches; slightly acid.

The A horizon ranges from black to dark gray in 2.5Y and 10YR hue. Texture is silt loam or clay loam. This horizon is slightly to strongly effervescent. Thickness ranges from 16 to 24 inches.

The O horizon ranges from black and very dark gray to very dark brown in 2.5Y and 10YR hue. In places it is intermixed with the C mineral horizon.

The C horizon ranges from light gray to dark gray in 2.5Y and 10YR hue. Texture is silt loam, silty clay loam, or silty clay.

These soils are typically slightly saline-alkali. In a few areas they are moderately saline-alkali.

210—Thapto-Histic Fluvaquents. This nearly level soil generally occurs in basins. The profile described as a reference for the subgroup is in this map unit. Slopes are less than 2 percent.

About 5 percent of this unit is included areas of Chino silty clay loam, 3 percent Bolsa silt loam, 3 percent Bolsa silty clay loam, and 2 percent Omni clay. Also included are some areas where the slopes are 5 percent.

If the soil is bare, runoff is slow and the erosion hazard is slight.

This soil is used for row crops and field crops. Capability unit IIIw–6 (19); range site not assigned; Storie index 22.

Tidal Flats

211—Tidal flats are nearly level areas adjacent to bays and lagoons along the coast. Periodically they are covered by tidal overflow. Some of the higher areas are covered only during very high tides. Tidal flats are stratified clayey to sandy deposits. They are poorly drained and are high in salts. The vegetation varies from none in the low areas to sparse, salt-tolerant plants in the higher areas.

Runoff generally ponds. Deposition from surrounding areas is a hazard.

Present land use is recreation and wildlife habitat. Some areas have been dredged or filled and converted to beaches for urban use. Capability unit VIIIw–1 (19); range site not assigned; Storie index less than 10 (nonagricultural).

Tollhouse Series

The Tollhouse series consists of excessively drained soils in the mountains. These soils formed in material weathered from granodiorite. Slopes are 30 to 75 percent. Elevation ranges from 3,000 to 5,500 feet. The vegetation is brush and an understory of annual grasses and forbs and in some areas thin stands of oaks or Coulter pines. Precipitation is 20 to 30 inches, and the mean annual air temperature is about 57°F. The frost-free season is 150 to 180 days.

In a typical profile the surface layer is very dark grayish brown and brown, slightly acid coarse sandy loam 8 inches thick. The underlying material is light yellowish brown weathered granodiorite to a depth of 28 inches or more that grades to unweathered rock. About 10 percent of the surface area is Rock outcrop.

Permeability is rapid. Available water capacity is 1 to 2 inches. The effective rooting depth is 7 to 18 inches for annual grasses and forbs. Brush and trees can easily penetrate the weathered granodiorite along fractures.

Tollhouse soils are used for wildlife habitat, recreation, and watershed and, to a limited extent, for range.

Typical profile of Tollhouse coarse sandy loam, in an area of Tollhouse-Rock outcrop complex, 30 to 75 percent slopes, in the Trabuco Ranger District, Cleveland National Forest (north), NE¼NW¼ sec. 27, T. 5 S., R. 6 W., Riverside County, about 1 mile down Indian Road from Main Divide Road:

O1—¼ inch to 0; partly decomposed grass, brush, and leaves; many small gravel-size (mostly ¼") granitic rock fragments.

A11—0 to 2 inches; very dark grayish brown (10YR 3/2) coarse sandy loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and medium roots; many very fine and fine tubular pores; slightly acid; abrupt smooth boundary.

A12—2 to 8 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine and common medium and coarse roots; many very fine and fine tubular pores; slightly acid; gradual wavy boundary.

Cr—8 to 28 inches; light yellowish brown (10YR 6/4) weathered granodiorite, easily cut with a spade.

The A horizon ranges from very dark grayish brown to grayish brown or brown in 10YR hue. The texture is sandy loam or coarse sandy loam. The thickness ranges from 7 to 18 inches. This horizon is slightly acid to medium acid.

The Cr horizon ranges from brown to light yellowish brown in 10YR hue. Reaction ranges from slightly acid to medium acid. Depth to unweathered rock is several feet.

212—Tollhouse-Rock outcrop complex, 30 to 75 percent slopes. This steep to very steep complex generally occurs on mountain ridges and north-facing mountainsides. The Tollhouse soil has the profile described as typical of the series. Large boulders or Rock outcrop occupies 10 to 30 percent of the surface area.

About 6 percent of the complex is included areas of Cieneba-Rock outcrop complex, 4 percent Cieneba sandy loam, and 3 percent Vista coarse sandy loam.

If the soil is bare, runoff is rapid and the erosion hazard is high.

This complex is used for wildlife habitat, recreation, watershed and, to a limited extent, for range. Capability unit VIIs–1 (20); Shallow Loamy-Rock outcrop complex range site; Storie index 5.

Vista Series

The Vista series consists of well drained soils in the mountains. These soils formed in material weathered from granitic rock. Slopes are 9 to 65 percent. Elevation is 1,000 to 4,000 feet. The vegetation is mostly brush, some California oaks, and in some areas an understory of annual grasses. Precipitation is 16 to 22 inches, and the mean annual air temperature is about 60° F. The frost-free season is 240 to 320 days.

In a typical profile the surface layer is grayish brown and brown coarse sandy loam 19 inches thick. The subsoil is pale brown and light yellowish brown coarse sandy loam 20 inches thick. The substratum is brownish yellow, weathered granitic rock.

The soil is slightly acid to neutral. It is moderately rapidly permeable.

Vista soils are used for pasture, range, watershed, and wildlife habitat.

Typical profile of Vista coarse sandy loam, 15 to 30 percent slopes, in the Cleveland National Forest (north), NE¼NE¼ sec. 23, T. 6 S., R. 6 W., Orange County:

A11—0 to 2 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; few very fine tubular pores; neutral; abrupt smooth boundary.

A12—2 to 10 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; common very fine and fine tubular pores; neutral; clear smooth boundary.

A13—10 to 19 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; slightly acid; gradual smooth boundary.

B21—19 to 31 inches; pale brown (10YR 6/3) coarse sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few very fine and fine roots; common very fine, fine, and coarse tubular pores; slightly acid; gradual wavy boundary.

B22—31 to 39 inches; light yellowish brown (10YR 6/4) coarse sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; very few very fine roots and common medium roots; common fine and medium tubular pores; slightly acid; abrupt wavy boundary.

Cr—39 to 55 inches; brownish yellow (10YR 6/6) weathered granitic rock, yellowish brown (10YR 5/6) moist; massive; hard, friable, nonsticky and nonplastic; few fine and medium roots in upper few inches along fractures; very few fine and medium tubular pores in upper few inches; slightly acid.

Color of the A horizon ranges from dark grayish brown and grayish brown to brown in 10YR hue. Texture is coarse sandy loam or sandy loam. Thickness ranges from 10 to 20 inches.

Color of the B horizon ranges from brown and pale brown to light yellowish brown in 10YR hue. Texture

is coarse sandy loam or sandy loam. Reaction ranges from neutral to slightly acid. Thickness ranges from 10 to 20 inches.

The weathered granitic rock grades to hard rock with increasing depth.

213—Vista coarse sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on broad hilltops.

About 5 percent of this mapping unit is included areas of Vista-Rock outcrop complex, 5 percent Cieneba sandy loam, 5 percent Blasingame loam, 2 percent Ramona fine sandy loam, and 2 percent Capistrano sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate. Available water capacity is 3.0 to 5.0 inches. The effective rooting depth is 30 to 40 inches.

This soil is used for pasture, range, watershed, and wildlife habitat. Capability unit IVe–1 (19); Loamy range site; Storie index 51.

214—Vista coarse sandy loam, 15 to 30 percent slopes. This moderately steep soil commonly occurs on hilltops. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Vista-Rock outcrop complex, 5 percent Cieneba sandy loam, 5 percent Blasingame loam, 3 percent Escondido very fine sandy loams, and 2 percent Ramona fine sandy loam.

If the soil is bare, runoff is medium and the erosion hazard is high. Available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 40 inches.

This soil is used for pasture, range, watershed, and wildlife habitat. Capability unit VIe–1 (19); Loamy range site; Storie index 36.

215—Vista coarse sandy loam, 30 to 65 percent slopes. This steep to very steep soil generally occurs on side slopes.

About 10 percent of this mapping unit is included areas of Cieneba sandy loam, 5 percent Blasingame loam, and 10 percent Vista-Rock outcrop complex.

If the soil is bare, runoff is rapid to very rapid and the erosion hazard is high to very high. Available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 36 inches.

This soil is used for watershed and wildlife habitat. Capability unit VIIe–1 (19); Loamy range site; Storie index 15.

216—Vista-Rock outcrop complex, 9 to 30 percent slopes. This strongly sloping to moderately steep mapping unit generally occurs as oblong areas 10 to 200 acres in size. About 10 percent of the surface area is Rock outcrop and 10 to 20 percent is large boulders.

About 5 percent of this mapping unit is included areas of Vista coarse sandy loam, 5 percent Cieneba-Rock outcrop complex, 5 percent Blasingame-Rock outcrop complex, 2 percent Ramona fine sandy loam, and 2 percent San Emigdio fine sandy loam.

If the soil is bare, surface runoff is medium and the erosion hazard is moderate. Available water capacity is 2.5 to 5.0 inches. The effective rooting depth is 24 to 36 inches.

This soil is used for range, watershed, and wildlife habitat. Capability unit VIs–1 (19); Loamy-Rock outcrop complex range site; Storie index 19.

Xeralfic Arents, Loamy

Xeralfic Arents, loamy, are moderately well drained or well drained soils. About 85 percent of the acreage is cut and fill land, and 15 percent undisturbed soil. Cut and fill land is the result of mechanical manipulation of terrace areas, usually of Myford and Yorba soils or other similar soils, for urban use. The building pads are nearly level. Elevation ranges from 50 to 1,500 feet. Precipitation is 12 to 16 inches, and the mean annual air temperature is about 61° F. The frost-free season is 300 to 350 days.

The texture of Xeralfic Arents, loamy, is generally sandy clay loam when reshaping is completed. Colors vary in 5YR, 7.5YR, and 10YR hue. Most characteristics of the undisturbed soil have been altered because of mechanical mixing. Few remnants of former argillic horizons remain, and they are not continuous.

Reaction ranges from slightly acid to moderately alkaline. Permeability is slow to very slow depending on compaction and mixing during construction. The shrink-swell hazard is moderate to high.

217—Xeralfic Arents, loamy, 2 to 9 percent slopes. The slope of these areas was determined from the undisturbed landscape. Present land use is primarily apartment houses, single family houses, shopping centers, and some industrial buildings.

Runoff is rapid, and the erosion hazard is high. Capability unit and range site not assigned; Storie index less than 10 (nonagricultural).

218—Xeralfic Arents, loamy, 9 to 15 percent slopes. The slope of these areas was determined from the undisturbed landscape. Present land use is primarily single family houses.

Runoff is rapid, and the erosion hazard is high. Capability unit and range site not assigned; Storie index less than 10 (nonagricultural).

Xerorthents Loamy, Cut and Fill Areas

Xerorthents loamy, cut and fill areas, are moderately well drained or well drained. About 95 percent of the acreage is cut and fill land, and 5 percent undisturbed soil. Cut and fill land is the result of mechanical manipulation of upland areas, generally Alo, Alo variant, Anaheim Balcom, Bosanko soils, or other similar soils, for urban use. The building pads are nearly level. Elevation ranges from 200 to 1,500 feet. Precipitation is 12 to 16 inches, and the mean annual air temperature is about 61° F. The frost-free season is 270 to 350 days.

The texture is loam, clay loam, or clay mixed with 70 to 85 percent crushed soft shale or sandstone, or both. Colors vary in the 7.5YR, 10YR, and 2.5Y hue. Reaction ranges from mildly alkaline to moderately alkaline. Most areas are calcareous throughout.

Permeability is moderately slow to slow depending on compaction during construction. The shrink-swell hazard is moderate. Depth to hard bedrock ranges from 10 to 60 inches.

219—Xerorthents loamy, cut and fill areas, 9 to 15 percent slopes. The slope of these areas was determined from the undisturbed landscape. Present land use is apartment houses and single family houses.

Runoff is rapid, and the erosion hazard is high.

Capability unit and range site not assigned; Storie index less than 10 (nonagricultural).

220—Xerorthents loamy, cut and fill areas, 15 to 30 percent slopes. The slope of these areas was determined from the undisturbed landscape (fig. 3). Present land use is primarily single family houses.

Runoff is rapid, and the erosion hazard is high. Capability unit and range site not assigned; Storie index less than 10 (nonagricultural).

Yorba Series

The Yorba series consists of well drained soils on terraces. These soils formed in gravelly sandy sediment. Slopes are 2 to 50 percent. Elevation ranges from 100 to 2,500 feet. The vegetation is annual grasses and forbs and some sagebrush and cactus. Precipitation is 12 to 20 inches, and the mean annual air temperature is about 62° F. The frost-free season is 300 to 350 days.

In a typical profile the surface layer is pinkish gray and brown gravelly sandy loam 11 inches thick. The subsoil is red, very gravelly sandy clay loam and sandy loam to a depth of 63 inches or more.

The soil is slightly acid throughout. It is slowly permeable.

Yorba soils are used for pasture, range, watershed, wildlife, and urban development.

Typical profile of Yorba gravelly sandy loam, 2 to 9 percent slopes, on the Irvine Ranch, NE¼NE¼ sec. 18 (by private survey), T. 4 S., R. 8 W., Orange County, rifle range area near Irvine Park and Santiago Creek:

A11—0 to 3 inches; pinkish gray (7.5YR 6/2) gravelly sandy loam, brown (7.5YR 4/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; common very fine tubular pores; 15 percent pebbles and cobbles; slightly acid; abrupt smooth boundary.

A12—3 to 11 inches; brown (7.5YR 5/2) gravelly sandy loam, brown (7.5YR 4/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; many very fine tubular pores; 15 percent pebbles and cobbles; slightly acid; abrupt smooth boundary.

B21t—11 to 25 inches; red (2.5YR 5/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; weak medium angular blocky structure; very hard, firm, sticky and very plastic; very few very

Figure 3.—Xerothents loamy, cut and fill areas, 15 to 30 percent slopes.

fine roots; common very fine tubular pores; many moderately thick clay films on peds and as bridges; 50 percent pebbles and cobbles; slightly acid; diffuse boundary.

B22t—25 to 40 inches; red (2.5YR 5/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; weak medium angular blocky structure; very hard, firm, sticky and very plastic; very few very fine roots; common very fine tubular pores and common fine interstitial pores; many moderately thick clay films on peds and as bridges; 50 percent pebbles and cobbles; slightly acid; gradual smooth boundary.

B3t—40 to 63 inches; red (2.5YR 5/6) very gravelly sandy loam, dark red (2.5YR 3/6) moist; massive; hard, friable, sticky and slightly plastic; very few very fine roots; many very fine and fine interstitial pores; common thin clay bridges; 60 percent pebbles and cobbles; slightly acid.

The A horizon ranges from pinkish gray, brown, and dark grayish brown to light brownish gray in 7.5YR and 10YR hue. Texture is gravelly or cobbly sandy loam or loam. Reaction ranges from medium acid to slightly acid. This horizon is 5 to 25 percent pebbles and cobbles. Thickness ranges from 9 to 18 inches.

The B2t horizon ranges from brown, dark brown, and yellowish red to red in 2.5YR, 5YR and 7.5YR hue. Texture is generally very gravelly or cobbly sandy clay loam or clay loam. Reaction ranges from medium acid to moderately alkaline. This horizon is 35 to 65 percent pebbles and cobbles. Thickness ranges from 18 to 30 inches. The B3t horizon is similar to the B2t horizon, but it contains somewhat less clay.

221—Yorba gravelly sandy loam, 2 to 9 percent slopes. This gently sloping to moderately sloping soil generally occurs on broad terraces. It has the profile described as typical of the series.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 3 percent Soper gravelly loam, 5 percent Gabino gravelly clay loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is medium and the erosion hazard is moderate. The effective rooting depth is 9 to 18 inches. Few roots penetrate the subsoil. Available water capacity is 4.0 to 5.0 inches.

This soil is used for pasture, range, and urban development. Capability unit IVe–3 (19); Claypan range site; Storie index 41.

222—Yorba gravelly sandy loam, 9 to 15 percent slopes. This strongly sloping soil generally occurs on terraces.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Gabino gravelly clay loam, 3 percent Soper gravelly loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The effective rooting depth is 9 to 18 inches. Few roots penetrate the subsoil. Available water capacity is 4.0 to 5.0 inches.

This soil is used for pasture, range, watershed, and urban development. Capability unit IVe–3 (19); Claypan range site; Storie index 39.

223—Yorba gravelly sandy loam, 15 to 30 percent slopes. This moderately steep soil generally occurs on terrace escarpments.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Gabino gravelly clay loam, 3 percent Soper gravelly loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The effective rooting depth is 9 to 18 inches. Few roots penetrate the subsoil. Available water capacity is 4.0 to 5.0 inches.

This soil is used for range and watershed. Capability unit VIe–1 (19); Claypan range site; Storie index 28.

224—Yorba cobbly sandy loam, 9 to 30 percent slopes. This strongly sloping to moderately steep soil generally occurs on terrace escarpments. The profile is similar to the one described as typical of the series, but the surface layer is cobbly sandy loam.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Gabino gravelly clay loam, 3 percent Soper cobbly loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The effective rooting depth is 9 to 18 inches. Few roots penetrate the subsoil. Available water capacity is 4.0 to 5.0 inches.

This soil is used for pasture and range. Capability unit VIs–1 (19); Claypan range site; Storie index 28.

225—Yorba cobbly sandy loam, 9 to 30 percent slopes, eroded. This strongly sloping to moderately steep soil generally occurs on concave terraces. The profile is similar to the one described as typical of the series, but the surface layer is cobbly sandy loam and is severely eroded. On as much as 50 percent of the acreage, the subsoil is exposed or frequent deep gullies occur that prevent tillage.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Gabino gravelly clay loam, 3 percent Soper cobbly loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The effective rooting depth is 5 to 9 inches. Few roots penetrate the subsoil. Available water capacity is 3.0 to 4.0 inches.

This soil is used for pasture and range. Capability unit VIIs–1 (19); Claypan range site; Storie index 12.

226—Yorba cobbly sandy loam, 30 to 50 percent slopes. This steep soil generally occurs on terrace escarpments. The profile is similar to the one described as typical of the series, but the surface layer is cobbly sandy loam.

About 5 percent of this mapping unit is included areas of Myford sandy loam, 5 percent Gabino gravelly clay loam, 3 percent Soper cobbly loam, and 2 percent Modjeska gravelly loam.

If the soil is bare, runoff is rapid and the erosion hazard is high. The effective rooting depth is 9 to 18 inches. Few roots penetrate the subsoil. Available water capacity is 4.0 to 5.0 inches.

This soil is used for range, watershed, and wildlife habitat. Capability unit VIIs–1 (19); Claypan range site; Storie index 14.

Use and Management of the Soils

In this section the capability classification system used by the Soil Conservation Service is described. The capability units are explained, and management is suggested for the soils in each capability unit. Estimated acre yields of the major crops are listed for those soils in the counties used for crops. The management required to obtain those yields is described, and the Storie index is explained. Also on the pages that follow is information on range sites, wildlife habitat, and engineering.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, for engineering, or for other unrelated soil uses.

In the capability system, all kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These groups are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices, or both.

Class III soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife. (None in this survey area)

Class VI soils have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial production of crops and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

Capability units in California in classes I through IV are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. Except for class I, the numbers that designate units within the classes and subclasses are:

0. A problem or limitation caused by sand and gravel in the substratum, which limits root penetration.
1. An actual or potential erosion hazard.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation caused by slow or very slow permeability of the subsoil or substratum.
4. A problem or limitation caused by coarse soil texture or excessive gravel.
5. A problem or limitation caused by a fine textured or very fine textured surface soil.
6. A problem or limitation caused by salts or alkali.
7. A problem or limitation caused by cobbles, stones, or rocks.
8. A problem or limitation caused by nearly impervious bedrock or a hardpan within the effective rooting depth.
9. A problem or limitation caused by low fertility or by toxicity. (None in this survey area)

Soils in classes V through VIII are given the nonconnotative number 1. Where these soils are used for

range, they are discussed in more detail under the heading "Range."

Land Resource Areas

The Orange County and Western Part of Riverside County survey area is divided into two land resource areas based on soil, climate, topography, vegetation, and land use. These areas are designated nationally as 19 and 20. The major land resource area, 19, consists of all areas except those above 3,000 feet on north- and east-facing slopes in the Santa Ana Mountains. Only two series, Laughlin and Tollhouse, have the characteristic that would place them in resource area 20. Other soils in the Santa Ana Mountains at elevations above 3,000 feet are generally on west- and south-facing slopes, which have the warmer climatic conditions of resource area 19.

Soils in these two resource areas may be similar and have the same capability unit symbol, but management needs may differ. These differences result from climate, vegetation, and kinds of crops that can be grown. For these reasons, capability unit symbols are followed by numbers 19 or 20 to identify the two resource areas. For example, soils in capability units VIIe–1 (19) and VIIe–1 (20) may be similar, but there is a brush cover in resource area 19 and a grass cover with light stands of pines or oaks in resource area 20.

Resource area 19

This area consists of a narrow strip of beaches and tidal flats along the coast and a gently sloping alluvial flood plain, in the northwestern part of Orange County, which extends from the beaches and tidal flats to the vicinity of Fullerton to Orange and Tustin and in a small southward loop below El Toro Marine Corps Air Station to about the intersection of the San Diego and Santa Ana freeways. Also included are rolling foothills and terraces that are adjacent to the flood plain in the northern part of the county and to the coast in the southern part and extend north along the Santa Ana Mountains. Also in area 19 are the Santa Ana Mountains, except for a few north- and east-facing slopes above 3,000 feet, and some valleys and terraces on the east side of the Santa Ana Mountains in Riverside County.

The elevation range is sea level to about 3,000 feet. Many south- and west-facing slopes in the Santa Ana Mountains that range to about 4,000 feet, however, have a warm enough climate to be included in resource area 19. Rainfall ranges from 10 inches along the coast to 25 inches inland and occurs mainly between November and March. The frost-free season is 200 to 350 days. Frosts are light and infrequent.

The land capability classification for the soils in area 19 is based on the assumption that water is available for irrigation. The generally mild climate favors the development of intensive agriculture, including highly specialized row and field crops, citrus, and avocados. Soil erosion, water runoff, and irrigation management are the major problems.

Resource area 20

In resource area 20 are areas in the Santa Ana Mountains that are above 3,000 feet elevation. Santiago Peak, the highest elevation, is 5,687 feet above sea level. Topography is dominantly steep and very steep. Many of the south- and west-facing slopes that range to 4,000 feet have a warm enough climate to be included in resource area 19.

Precipitation, including some light snowfall, ranges from 20 to 30 inches. Most of the precipitation occurs between November and March.

The land capability classification for the soils in area 20 is based on their suitability for nonirrigated farming. Most of the acreage is used for range, watershed, wildlife habitat, and recreation. The major problems are runoff and erosion.

Management by Capability Units

Utilization of crop residue, minimum tillage, cover crops, and fertilization is common management in the survey area.

Disking or plowing under the tree prunings, tomato and bean vines, sugar beet tops, and other crop residue provides organic matter and reduces soil loss through erosion. Additions of organic matter increase fertility, aeration, and moisture penetration and maintain or improve soil structure.

Minimum tillage helps in maintaining soil structure and reducing compaction by influencing air and water movement through the soil. Chemical weed control reduces the amount of tillage needed. Proper timing of tillage is important. All tilling should be done when moisture conditions are such that compaction and pulverization can be kept to a minimum. Well designed access roads that minimize travel on the soil help in reducing compaction.

Cover crops are effective in improving and protecting cropland and orchards during winter. When utilized as green manure, they also add organic matter. Ryegrass, barley, and volunteer forbs and grasses improve water intake and thus protect the soil against water erosion and soil blowing.

Fertilization is generally needed to maintain or increase soil productivity. The kinds and amounts of fertilizer vary according to the crop. All crops but forage legumes respond to nitrogen. Legumes, truck crops, and field crops respond to phosphorus. Some crops are deficient in zinc and other microelements. Citrus and avocados on Balcom, Metz, Mocho, Nacimiento, San Emidgio, and other highly calcareous soils are subject to chlorosis.

It is assumed that irrigation water is available, or can be made available, for all arable soils in the area.

In the following pages the capability units in the survey area are described and the use and management of the soils is suggested. The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all soils of a given series are in the unit.

CAPABILITY UNIT I (19)

This unit consists of sandy loams, loams, silt loams, silty clay loams, and clay loams on fans and flood plains. These are soils of the Bolsa, Chino, Hueneme, Mocho, San Emigdio, and Sorrento series. They formed in alluvium dominantly from sedimentary sources. Most are well drained. In some, drainage has been

improved and the water table is no longer a concern to management. Slopes are 0 to 2 percent. The annual rainfall is 12 to 18 inches, and the frost-free season is 270 to 355 days. Permeability is moderately rapid to moderately slow. Runoff is slow, and the erosion hazard is slight. Roots and water easily penetrate these soils to a depth of 60 inches or more. Available water capacity is 7.0 to 13.0 inches.

These soils are suited to a wide variety of irrigated row crops, specialty crops, and field crops. Strawberries are grown on San Emigdio soils, where they are less prone to disease, have less fruit rot, and are easier to harvest than on the finer textured soils.

These soils can usually be leveled without exposing unfavorable underlying materials. Soil fertility, structure, and tilth can be maintained or improved by growing green manure crops, planting annual winter cover crops in groves or orchards, returning all crop residue to the soil, and applying livestock manure. Fertilizer should be applied according to the needs of each crop and the kinds of soil.

CAPABILITY UNIT IIe–1 (19)

This unit consists of sandy loams to clay loams on alluvial fans and narrow valley fills. These are soils of the Botella, Garretson, Hanford, Mocho, San Emigdio, and Sorrento series. They are well drained. Slopes are 2 to 9 percent. The annual rainfall is 12 to 20 inches, and the frost-free season is 250 to 355 days. Permeability is moderately rapid to moderately slow. Runoff is slow to medium, and the erosion hazard is slight to moderate. Roots and water easily penetrate these soils to a depth of 60 inches or more. Available water capacity is 6.0 to 13.0 inches.

These soils are suited to a wide variety of irrigated row crops, field crops, citrus, and avocados.

The risk of erosion is the main limitation. Sheet erosion can be controlled by tilling across the slope or on the contour and by preserving good soil structure and tilth through the use of crop residue or green manure crops. It can also be controlled by keeping cover crops on the soils during the rainy season.

Irrigation water can be applied by contour furrows, sprinklers, or drip systems. The irrigation system should provide for control of water and erosion and for disposal of tail water. These soils can usually be leveled without exposing unfavorable underlying materials.

CAPABILITY UNIT IIe–3 (19)

The one soil in this unit is Rincon clay loam, 2 to 9 percent slopes. It has a surface layer of clay loam and a slowly permeable, heavy clay loam subsoil. It formed on terraces in alluvium derived from sedimentary rocks. It is well drained. The annual rainfall is 12 to 18 inches, and the frost-free season is 270 to 300 days. Runoff is medium, and the erosion hazard is moderate. Root penetration into the subsoil is somewhat impeded, but roots commonly extend to a depth of 60 inches or more. Available water capacity in the root zone is 9.0 to 11.0 inches.

This soil is suited to many irrigated row crops, irrigated field crops, citrus, and dryland barley. It is not well suited to avocados.

Sprinklers, drip systems, or furrows on the contour are satisfactory in irrigating. Runoff should be controlled. Erosion is a problem during the rainy season unless the soil surface is protected.

Organic matter supplied through the use of green manure crops, crop residue, or livestock manure is beneficial. Annual winter cover crops and minimum tillage improve water penetration and reduce erosion in citrus groves.

CAPABILITY UNIT IIe–5 (19)

The one soil in this unit, Cropley clay, 2 to 9 percent slopes, is on alluvial fans. It formed in alluvium derived from sedimentary rocks. It is clay throughout and cracks when dry. It is well drained. The annual rainfall is 10 to 20 inches, and the frost-free season is 280 to 340 days. Permeability is slow. Runoff is medium, and the erosion hazard is slight. Roots can penetrate to a depth of 60 inches or more. Available water capacity is 8.0 to 10.0 inches.

This soil is suited to many irrigated row crops, field crops, citrus, and dryland barley.

Growing green manure crops, utilizing crop residue, and applying livestock manure improve soil tilth and increase the supply of organic matter.

Erosion is a serious problem during the rainy season unless the soil surface is protected. Adequate provisions to control irrigation runoff are also needed.

This soil is difficult to work and should be worked within only a narrow range of moisture content. If cultivated when dry, it breaks into large hard clods. If cultivated when wet, the soil structure is easily damaged.

CAPABILITY UNIT IIw–2 (19)

This unit consists of fine sandy loams, silt loams, and silty clay loams on alluvial fans and flood plains. These are soils of the Bolsa, Chino, and Hueneme series. They formed from mixed but dominantly sedimentary sources. They are somewhat poorly drained or poorly drained and have a water table at a depth of 40 to 60 inches. Slopes are 0 to 2 percent. The annual rainfall is 12 to 15 inches, and the frost-free season is 300 to 350 days. Permeability is moderately rapid or moderately slow. Runoff is very slow or slow, and the erosion hazard is none to slight. Roots easily penetrate these soils to a depth of 40 to 60 inches, depending on the depth of the water table. Available water capacity in a drained soil is 7.0 to 9.0 inches.

These soils are suited to a wide variety of irrigated row crops and field crops. Strawberries are usually not grown on the soils in this area because they are more prone to disease and fruit rot. Also, they are more difficult to harvest than on coarser textured, somewhat excessively drained soils. Citrus and avocados are not suited because of the high water table.

These soils can usually be leveled without exposing unfavorable underlying material. Open ditches or tile drains help maintain the water table at a uniform depth. Disposal of excess surface water reduces ponding.

Growing green manure crops, returning all crop residue to the soil, and applying livestock manure maintain or improve soil fertility, structure, and tilth.

CAPABILITY UNIT IIs–3 (19)

The one soil in this unit, Omni silt loam, drained, is on flood plains and in basins. It formed in mixed alluvium. It has altered drainage, and the water table is lowered to 60 inches or more. The surface layer is 10 to 14 inches thick over clay, which extends to a depth of 60 inches or more. Slopes are 0 to 2 percent. The annual rainfall is 12 to 14 inches, and the frost-free season is 280 to 300 days. Permeability is slow. Runoff is very slow, and the erosion hazard is none to slight. Roots can penetrate, but not easily, to a depth of 60 inches or more in the clay underlying material. Available water capacity is 8.5 to 12.0 inches.

The soil is suited to a wide variety of row crops, field crops, and dryland barley. It is not suited to citrus, avocados, or many other tree crops.

Skillful irrigation management is needed to prevent the surface layer from becoming too saturated and to avoid a perched water table above the clay layer. Irrigation systems should provide for disposal of excess tail water to prevent ponding.

Growing green manure crops, returning all crop residue to the soil, and applying livestock manure maintain or improve soil fertility, structure, and tilth.

CAPABILITY UNIT IIs–4 (19)

This unit consists of soils of the Corralitos and Metz series. These soils have a loamy sand surface layer, stratified sand to very fine sandy loam underlying layers, and at a depth between 40 and 60 inches a silt loam or silty clay loam layer 2 to 6 inches thick. The soils are somewhat excessively drained. Slopes are 0 to 2 percent. The annual rainfall is 12 to 20 inches, and the frost-free season is 230 to 350 days. Permeability is moderate to slow in the substratum. Runoff is slow, and the erosion hazard is slight. Available water capacity in the 60-inch root zone is 5.0 to 6.0 inches.

These soils are suited to irrigated row crops, strawberries, field crops, and citrus.

These soils can be irrigated with little risk of damage from erosion. Because of the coarse texture and the droughtiness, frequent, light irrigation is needed. Leveling for irrigation is not a problem if the cuts leave adequate root space above the moderately fine substratum.

Organic matter is rapidly depleted in these soils. It can be supplied by growing green manure crops, returning crop residue to the soil, and applying livestock manure.

CAPABILITY UNIT IIs–5 (19)

This unit consists of soils of the Cropley and Omni series on fans and in basins. These soils formed in alluvium. Both are clay throughout. The Cropley soil is well drained. The Omni soil has altered drainage and a water table at a depth of 60 inches or lower. Slopes are 0 to 2 percent. The shrink-swell potential is high. The annual rainfall is 10 to 20 inches, and the frost-free season is 280 to 340 days. Permeability is slow. Runoff is very slow to slow, and the erosion hazard is none to slight. Available water capacity is 8.0 to 12.0 inches.

These soils are suited to irrigated row crops, field crops, and dryland barley.

Growing green manure crops, utilizing all crop residue, and applying livestock manure improve soil tilth and increase the supply of organic matter. Erosion is no problem, but adequate control for irrigation runoff is needed.

These soils are difficult to work and can be worked within only a narrow range of moisture content. If they are cultivated when dry, large hard clods form. If they are cultivated when wet, the soil structure is easily damaged.

CAPABILITY UNIT IIIe–1 (19)

This unit consists of fine sandy loams, sandy loams, and clay loams. These are soils of the Balcom, Botella, Capistrano, and Ramona series. Balcom soils formed in weathered calcareous sandstone or shale. Botella and Capistrano soils formed in alluvium on fans and flood plains, mostly in small valleys. Ramona soils formed in granitic alluvium on terraces. Slopes are 2 to 15 percent. These soils are well drained. The annual rainfall is 12 to 25 inches, and the frost-free season is 240 to 350 days. Runoff is slow to medium, and the erosion hazard is moderate to high. Roots can penetrate to a depth of 26 to 36 inches in Balcom soils and to a depth of 60 inches or more in the other soils. Available water capacity is 4.0 to 6.0 inches in Balcom soils and 5.5 to 11.5 in the others.

These soils are suited to row crops, field crops, and citrus. Capistrano soils are also suited to avocados. Balcom soils are moderately high in lime, which can cause iron chlorosis in some crops.

Sprinklers, drip systems, and furrows on the contour are most satisfactory in irrigating. Erosion is the major problem. Tillage across the slope or on the contour reduces runoff and the risk of erosion.

Stubble mulching and returning all crop residue reduce runoff, maintain soil tilth, and improve water intake. Annual winter cover crops and minimum tillage improve water intake and reduce the risk of erosion in citrus and avocado groves.

CAPABILITY UNIT IIIe–3 (19)

This unit consists of soils in the Myford and Rincon series. These soils formed on terraces. Slopes are 2 to 15 percent.

Myford soils have a sandy loam surface layer and a sandy clay or sandy clay loam subsoil. They are moderately well drained, have a 20- to 30-inch effective rooting depth, and have an available water capacity of 3.0 to 5.5 inches. Permeability is very slow in the subsoil, and a perched water table is likely to form after excessive irrigation or rainfall.

Rincon soils have a clay loam surface layer and a clay loam or clay subsoil that is slowly permeable. They are well drained. Roots commonly extend to a depth of 60 inches or more, and the available water capacity is 9.0 to 11.0 inches.

The annual rainfall is 12 to 20 inches, and the frost-free season is 270 to 350 days. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Myford soils are best suited to irrigated pasture and dryland grazing. Rincon soils are suited to citrus and to many row and field crops.

Sprinklers, drip systems, and furrows on the contour are satisfactory in irrigating. Overirrigation and the resulting perched water table should be avoided. Con-

trolling runoff is needed. Erosion is a problem, especially during the rainy season, unless the soil is protected by a plant cover. Tillage should be across the slopes or on the contour. Land leveling should be avoided because deep cuts expose the clayey subsoil.

Additions of organic matter improve soil structure and tilth. Annual winter cover crops and minimum tillage improve water penetration and reduce the risk of erosion in citrus groves.

CAPABILITY UNIT IIIe-4 (19)

The one soil in this unit is Modjeska gravelly loam, 2 to 9 percent slopes. This well drained soil is on terraces. It formed in alluvium from mixed sources. The annual rainfall is 14 to 20 inches, and the frost-free season is 280 to 330 days. Permeability is moderate. Roots easily penetrate to a depth of 60 inches or more, even though the subsoil is very cobbly. Available water capacity is 4.5 to 6.0 inches.

This soil is suited to citrus, avocados, barley, pasture, and shallowly cultivated row and field crops.

Sprinklers and drip systems are most satisfactory in irrigating. Frequent, light irrigation is needed. Land leveling is impractical because the subsoil is very cobbly. Erosion is a problem especially during the rainy season. Tillage should be across the slopes or on the contour.

Additions of organic matter improve soil structure and tilth. Annual winter cover crops and minimum tillage improve water penetration and reduce the risk of erosion in citrus and avocado groves.

CAPABILITY UNIT IIIe-5 (19)

This unit consists of clays on foothills. These are soils of the Alo, Alo variant, and Bosanko series. They formed in weathered calcareous sandstone and shale. They are well drained. Slopes range from 9 to 15 percent. The annual rainfall is 12 to 20 inches, and the frost-free season is 280 to 350 days. Permeability is slow. Runoff is medium, and the erosion hazard is moderate. Roots can penetrate to a depth of 24 to 40 inches. Available water capacity is 3.0 to 7.0 inches.

These soils are suited to row crops planted on the contour and to dryland barley. They are moderately well suited to citrus.

Sprinklers, drip systems, and furrows on the contour are satisfactory in irrigating. Slow water intake, water runoff, and erosion are problems on these soils. Tillage should be done when soil moisture conditions are optimum to avoid puddling or the formation of large hard clods.

Addition of organic matter improves soil structure and tilth. Stubble mulching reduces the risk of erosion on barley fields. Annual winter cover crops and minimum tillage improve water penetration and reduce the erosion hazard in citrus groves.

CAPABILITY UNIT IIIw-6 (19)

In this unit are soils of the Omni series and Thapto-Histic Fluvaquents. These soils are on flood plains and in basins. Slopes are 0 to 2 percent. Omni soils are clay throughout. Thapto-Histic Fluvaquents are mainly clay loam and silty clay over peat. All are poorly drained and have a water table at a depth of 24 to 40 inches. All are moderately affected by salts. The annual rainfall is 12 to 14 inches, and the frost-free season is 280 to 350 days. Permeability is slow. Runoff is very slow to slow, and the erosion hazard is none to slight. Roots can easily penetrate as far down as the water table. In drained areas the available water capacity is 6.0 to 12.0 inches.

These soils are suited to moderately salt tolerant row crops and field crops. They are not suited to deep rooted crops and citrus or avocado trees. In places open ditches and tile drains are needed to lower the water table.

Erosion is no problem. Occasional overflow and ponding are hazards. Water disposal systems are needed in some areas. Irrigation should be regulated to supply enough water for crops and to avoid raising the water table. Occasional excessive irrigation is needed to leach excess salts from the root zone.

Growing green manure crops, returning all crop residue to the soil, and applying livestock manure help to maintain soil tilth and structure.

CAPABILITY UNIT IIIs-3 (19)

The one soil in this unit, Myford sandy loam, thick surface, is on terraces. It formed in alluvium. The subsoil is a very slowly permeable, dense sandy clay. Slopes are 0 to 2 percent. This soil is moderately well drained. The annual rainfall is 12 to 20 inches, and the frost-free season is 270 to 350 days. Runoff is slow, and the erosion hazard is slight. Roots can easily penetrate the 20- to 30-inch surface layer, but few roots extend into the subsoil. Available water capacity is 3.0 to 5.5 inches in the 20- to 30-inch effective rooting depth.

This soil is best suited to irrigated pasture, dryland pasture, and barley. Good irrigation management is important. Irrigation water must be applied carefully to avoid saturating the soil above the clayey subsoil. Land smoothing should be done carefully to avoid exposing the clayey subsoil.

Growing green manure crops, returning all crop residue to the soil, and applying livestock manure maintain or improve the soil tilth, structure, and fertility.

CAPABILITY UNIT IIIs-4 (19)

This unit consists of loamy sands and gravelly loams of the Corralitos, Marina, Metz, and Modjeska series. Corralitos and Metz soils formed in alluvium on flood plains and fans in small valleys. Marina and Modjeska soils formed on terraces. These soils are somewhat excessively drained and well drained. Slopes are 0 to 5 percent. The annual rainfall is 12 to 20 inches, and the frost-free season is 230 to 365 days. Permeability is rapid to moderate. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 60 inches or more. Available water capacity is 3.5 to 6.0 inches.

These soils are suited to irrigated row crops, field crops, citrus, and avocados. Most of the strawberries grown in this area are on Corralitos and Metz soils.

Proper irrigation management is essential. Frequent irrigation is needed because of the low water capacity and the rapid intake. Land leveling can be done on Corralitos, Metz, and Marina soils without exposing unfavorable materials. The subsoils of Modjeska soils are too cobbly for leveling.

Growing green manure crops, using all crop residue,

and applying livestock manure help to maintain soil tilth and structure.

CAPABILITY UNIT IVe-1 (19)

This unit consists of well drained sandy loams, loams, and clay loams on uplands and terraces. These are soils of the Anaheim, Balcom, Blasingame, Capistrano, Soper, Escondido, Nacimiento, Ramona, Modjeska, and Vista series. Some are gravelly. Anaheim, Balcom, Nacimiento, Blasingame, Escondido, Soper, and Vista soils formed in weathered sandstone or shale, granitic conglomerates, or metamorphosed sandstone on foothills. Capistrano and Ramona soils formed in granitic alluvium on terraces and fans. Slopes are 9 to 30 percent. The annual rainfall is 12 to 25 inches, and the frost-free season is 225 to 350 days. Permeability is moderately rapid to moderately slow. Runoff is medium to rapid, and the erosion hazard is moderate to high. Roots can penetrate to a depth of 24 to 40 inches in the upland soils and to a depth of 60 inches or more in the terrace soils. Available water capacity is 3.0 to 10.0 inches.

These soils are suited to citrus and irrigated row crops planted on the contour and to barley. Anaheim loam and Vista soils are suited to avocados. Balcom soils are moderately high in lime, which can cause iron chlorosis in some crops. Currently most of the acreage is not used for cultivated crops. It is used mainly for grazing.

Sprinklers and drip systems are most satisfactory in irrigating. Erosion is the major problem. Tillage should be on the contour to reduce runoff and the risk of erosion.

Returning all crop residue and stubble to the soils reduces runoff, maintains soil tilth, and improves water intake. Annual winter cover crops and minimum tillage improve water intake and reduce the risk of erosion in citrus and avocado groves.

CAPABILITY UNIT IVe-3 (19)

This unit consists of sandy loams, gravelly sandy loams, and clay loams on terraces. These are soils of the Myford, Rincon, and Yorba series. Myford soils have a very slowly permeable subsoil and are moderately well drained. Rincon and Yorba soils have a slowly permeable subsoil and are well drained. Slopes are 0 to 30 percent. The annual rainfall is 12 to 20 inches, and the frost-free season is 270 to 350 days. Runoff is medium to rapid, and the erosion hazard is moderate to high. Roots in the Myford and Yorba soils easily extend from 9 to 19 inches, but few roots extend into the subsoil. Available water capacity is 2.0 to 5.0 inches. Roots in the Rincon soils commonly extend from 40 to 60 inches or more, even though the subsoil impedes root growth. Available water capacity is 9.0 to 11.0 inches.

Myford and Yorba soils are best suited to irrigated pasture or dryland grazing. Rincon soils are suited to citrus, irrigated row crops, and barley planted on the contour.

Sprinklers and drip systems are most satisfactory in irrigating. Overirrigation is likely to cause a perched water table. Runoff should be controlled. Erosion is a problem, especially during the rainy season unless the soil is protected by a plant cover. Tillage should be on the contour.

Additions of organic matter maintain or improve soil structure and tilth. Annual cover crops and minimum tillage improve water penetration and reduce the risk of erosion in citrus groves.

CAPABILITY UNIT IVe-5 (19)

The soils in this unit are clays that formed on foothills in material weathered from calcareous sandstone and shale. These are soils of the Alo and Bosanko series and the Alo variant. They are well drained. Slopes are 15 to 30 percent. The average annual rainfall is 12 to 20 inches, and the average annual growing season is 280 to 350 days. Permeability is slow. Runoff is rapid, and the erosion hazard is moderate to high. The effective rooting depth is 24 to 36 inches. Available water capacity is 3.5 to 6.0 inches. Also in this unit are areas of the moderately slowly permeable, well drained Balcom clay loam, which is mapped with Bosanko clay.

These soils are suited to citrus and grain and, to a limited extent, to row crops planted on the contour.

Sprinklers or drip systems are most efficient in irrigating. Contour furrows can be used if properly managed. The intake rate is slow after the soil has been watered. All tillage should be on the contour to reduce the risk of erosion. It can be performed within only a narrow range of moisture content. If the soil is dry when tilled, large clods form; if wet, the surface compacts and seals over.

Additions of organic matter improve soil structure and tilth. Stubble mulching reduces the risk of erosion. Annual winter cover crops and minimum tillage improve water penetration and reduce the risk of erosion in orchards.

CAPABILITY UNIT IVs-4 (19)

The one soil in this unit, Marina loamy sand, 2 to 9 percent slopes, formed on terraces near the coast in old eolian sands. It is somewhat excessively drained. The annual rainfall is 12 to 15 inches, and the frost-free season is 320 to 365 days. Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. Roots penetrate to a depth of 60 inches or more. Available water capacity is 3.5 to 5.0 inches.

This soil is suited to irrigated row crops, citrus, and avocados. Most of the acreage, however, is now under urban development.

Sprinklers and drip systems are most satisfactory in irrigating. Frequent, light irrigations are required because of the low available water capacity. Tillage should be across the slope or on the contour.

Additions of organic matter maintain or improve soil structure and tilth. Annual winter cover crops and minimum tillage improve water penetration and reduce the risk of erosion in citrus and avocado groves.

CAPABILITY UNIT VIe-1 (19)

This unit consists of loamy sands and clays on terraces and uplands. These are soils of the Alo, Anaheim, Balcom, Blasingame, Bosanko, Chesterton, Cieneba, Escondido, Myford, Nacimiento, San Andreas, Soper, Vista, and Yorba series and the Alo variant. These

soils are moderately well drained and well drained. Slopes are 2 to 50 percent. The annual rainfall is 12 to 25 inches, and the frost-free season is 200 to 350 days. Permeability is very slow to moderately rapid. Runoff is medium to rapid, and the erosion hazard is moderate to high. Roots can penetrate from 10 to 40 inches. Available water capacity is 1.0 to 7.0 inches.

These soils are suited to range, watershed, and wildlife habitat. All but Chesterton, Cieneba, Myford, and Yorba soils are moderately suited to citrus. Cieneba, San Andreas, and Vista soils are suited to avocados.

Sprinklers and drip systems are most satisfactory in irrigating groves. Runoff and erosion are major problems. Cover crops and nontillage are the most suitable methods of erosion and runoff control in citrus or avocado groves.

Proper range management is needed to increase the quality and quantity of desirable plants for forage, to provide cover for erosion control, and to reduce runoff. Seeding of burned areas with suitable grasses and legumes may be necessary to replace the vegetation needed for erosion control and grazing.

CAPABILITY UNIT VIs–1 (19)

This unit consists of sandy loams, loamy sands, loams, and clay loams. These are soils of the Balcom, Blasingame, Cieneba, Gabino, Soboba, Vista, and Yorba series. Soboba soils, on alluvial fans and flood plains, are excessively drained. Yorba soils, on terraces, are well drained. The rest, on uplands, are well drained or somewhat excessively drained. They formed in material weathered from sandstone, shale, granite, or metamorphic rock conglomerate. Some soils in this unit are mapped with Rock outcrop. Some are stony or cobbly. Slopes are 0 to 50 percent. The annual rainfall is 12 to 25 inches, and the frost-free season is 200 to 350 days. Permeability is moderately rapid to slow on the uplands and terraces and very rapid on the fans and flood plains. Soboba soils have an available water capacity of 2.0 to 3.0 inches in the 60-inch root zone. Yorba soils have an effective rooting depth of 9 to 18 inches for many plant roots and an available water capacity of 4.0 to 5.0 inches. The remaining soils have an effective rooting depth of 15 to 40 inches and an available water capacity of 2.0 to 6.0 inches. Runoff is slow to medium on Soboba soils, and the erosion hazard is slight to moderate. On the other soils runoff is medium to rapid, and the erosion hazard is high.

All but Yorba soils are suited to citrus. Cieneba, Soboba, and Vista soils are suited to avocados. All are suited to and used as range, watershed, and wildlife habitat. The Rock outcrop, stones, and cobbles associated with these soils somewhat limit the use of normal farm machinery.

Sprinklers or drip systems are the most satisfactory in irrigating citrus or avocados. Cover crops and no tillage in the citrus and avocado groves reduce runoff and the risk of erosion.

Proper range management is needed to maintain an adequate vegetative cover, to increase the quantity of forage, and to reduce the erosion hazard. These soils can be seeded to suitable annual grasses and forbs.

CAPABILITY UNIT VIIe–1 (19)

This unit consists of sandy loams, loams, and clay loams of the Anaheim, Calleguas, Cieneba, Friant, Las Posas, Myford, Soper, and Vista series. Myford soils are on terraces. The rest are on uplands. The upland soils are somewhat excessively drained or well drained; Myford soils are moderately well drained. Slopes are 15 to 75 percent on the upland soils and 9 to 30 percent on Myford soils. The annual rainfall is 12 to 25 inches, and the frost-free season is 200 to 350 days. Runoff is rapid to very rapid, and the erosion hazard is high to very high. Roots penetrate from 5 to 40 inches. Available water capacity is 0.75 to 6.5 inches.

These soils are suited to range, wildlife, watershed, and recreation. Runoff and erosion are the main hazards.

Proper grazing is needed to increase the quantity of desirable plants and usable forage. Maintaining an adequate cover of plants also helps to control erosion and runoff. Seeding burned areas should be done only for erosion control.

CAPABILITY UNIT VIIe–1 (20)

The only soil in this unit is Laughlin gravelly loam, 30 to 50 percent slopes. This well drained soil formed in material weathered from metamorphic rock. It is in mountainous areas. The annual precipitation, including a few light snowfalls, is 20 to 30 inches. The frost-free season is 150 to 180 days. Roots can easily penetrate from 24 to 40 inches. Available water capacity is 3.0 to 6.0 inches.

This soil is suited to grazing, wildlife, recreation, and watershed. Runoff and erosion are the main hazards.

Proper grazing is needed to increase the quality and quantity of desirable plants for forage. It also provides cover for erosion control and reduces runoff.

Seeding burned areas with suitable annual grasses and legumes helps in erosion control.

CAPABILITY UNIT VIIs–1 (19)

This unit consists of sandy loams and loams of the Blasingame, Cieneba, Exchequer, Soper, and Yorba series. These are well drained and somewhat excessively drained soils. Yorba soils are on terraces, and the other soils are on mountains or foothills. Slopes are 9 to 30 percent on Yorba soils and are 15 to 75 percent on the upland soils. Some of these soils are mapped with Rock outcrop. Some are stony or cobbly. The Rock outcrop, stones, or cobbles cover 10 to 50 percent of the surface area. The annual precipitation is 12 to 25 inches, and the frost-free season is 200 to 350 days. Roots can penetrate easily from 5 to 32 inches. Available water capacity is 0.75 to 4.5 inches. Runoff is rapid, and the erosion hazard is high.

These soils are suited to range, wildlife, watershed, and recreation. Erosion and surface rocks, stones, and cobbles are the main hazards.

Proper grazing is needed to maintain the forage and reduce the erosion hazard. The rocks, stones, and slopes preclude the use of any equipment. Seeding is of value only for erosion control. It is not economically feasible to improve the grazing capacity of these soils.

CAPABILITY UNIT VIIs–1 (20)

Only Tollhouse-Rock outcrop complex, 30 to 75 percent slopes, is in this unit. It is on uplands. The surface area is about 10 percent Rock outcrop. The Tollhouse

soil formed in material weathered from granodiorite. It is excessively drained. It is coarse sandy loam throughout. The annual precipitation, including a few light snowfalls, is 20 to 30 inches, and the frost-free season is 150 to 180 days. Roots can easily penetrate from 7 to 18 inches. Some tree and brush roots extend much deeper into the weathered granodiorite. Available water capacity is 1.0 to 2.0 inches.

This unit is suited to wildlife habitat, watershed, recreation, and limited grazing. Runoff and erosion are the main hazards.

Controlling grazing helps to maintain an adequate plant cover for control of runoff and erosion. Seeding in burned areas should be done only for erosion control.

CAPABILITY UNIT VIIIw–1 (19)

This unit consists of Beaches, Riverwash, and Tidal flats. Beaches are sandy, gravelly, or cobbly coastal shores. Tidal flats are nearly level, poorly drained, stratified clayey to sandy deposits that are adjacent to bays and lagoons along the coast and are high in salts. Both are subject to tidal action and may be at least partly inundated by high tides. Riverwash consists of sandy, gravelly, cobbly, stony, and bouldery deposits, along stream channels, that are subject to stream overflow.

Areas in this unit support little or no vegetation. They are suited to wildlife and recreation but have little or no agricultural value. Riverwash is a valuable source of sand and gravel for construction material.

Soil removal or deposition is a hazard during floods and storms. Protecting existing vegetation in these areas, maintaining dikes on Beaches, and protecting and realigning stream channels in areas of Riverwash reduce the removal and deposition hazards.

CAPABILITY UNIT VIIIs–1 (19)

This unit consists of Pits, open excavations from which soil and underlying material, generally sand or gravel, have been removed. The remaining material generally has low fertility and supports little or no vegetation. It has no agricultural value. The water that collects in Pits recharges the ground water.

Major problems are runoff and erosion and flooding in stream channel areas. Pits can be protected by use of mulches; fertilized plant cover, diversion ditches; and in stream channel areas, streambank protection or channel realignment.

Storie Index [2]

The soil mapping units of the area are rated according to the Storie index (*10, 11*). This index expresses numerically the relative degree of suitability of a soil for general intensive farming. The rating is based on soil properties and characteristics only. Other factors that might determine the desirability of growing certain plants in a given locality, such as availability of water for irrigation, climate, and distance from markets, are not considered. Therefore, the index should not be considered as a direct indicator of land value. Where economic factors are known to the user, however, the index provides additional objective information for land tract value comparisons.

[2] Prepared by GORDON L. HUNTINGTON, lecturer and soil specialist, University of California, Davis.

Four general factors are considered in the index rating. The factors are (A) the characteristics of the soil profile and soil depth; (B) the texture of the surface soil; (C) the dominant slope of the soil; and (X) other factors more readily subject to management or modification. In Orange County the X factors include drainage, salinity, alkalinity, general nutrient level of the soil, and erosion. For some soils more than one X factor may be involved.

Each of the four general factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable or ideal condition for crop production; lower percentage ratings express less favorable conditions for crop production. Factor ratings are selected from tables prepared from data and observations that have related soil properties to plant growth and crop yield (*9*).

The index rating for a soil is obtained by multiplying the three factors, A, B, and C with one or more X factors; thus, any factor may dominate or control the final rating. For example, Omni silt loam, drained, has a deep, slowly permeable profile, warranting a rating of 70 percent for factor A; a readily workable surface texture, warranting a rating of 100 percent for factor B; and a smooth, nearly level surface, justifying a rating of 100 percent for factor C. This soil is moderately well drained and slightly saline-alkali affected, which warrants respective ratings of 90 and 80 percent or a combined rating of 72 percent for factor X. Multiplying these four factors gives an index rating, rounded to the nearest whole number, of 50 percent for this Omni soil. If the saline-alkali problem is corrected, the Storie index should be reevaluated by assigning a value of 90 to the X factor to reflect the changed condition, assuming that the soil remains moderately well drained.

Soil complexes mapped in this area, for example, Blasingame-Vista complex, are rated according to the appropriate factors for the dominant soils in each unit. Thus, the index ratings reflect the proportions of the dominant soils in a complex or the proportions of different soils in a tract or field. The latter is done by an acreage-weighted averaging of the Storie index values of the different soils in a tract or field.

Soils are graded according to their suitability for general intensive farming as shown by their Storie index ratings. The following tabulation shows the six grades and the range in index ratings:

	Index rating
Grade 1	80 to 100
Grade 2	60 to 79
Grade 3	40 to 59
Grade 4	20 to 39
Grade 5	10 to 19
Grade 6	Less than 10

Soils in grade 1 are excellent and are very well suited to general intensive farming. Grade 2 soils are good and are well suited to general farming, but are not so desirable as soils in grade 1. Grade 3 soils are only fairly well suited, grade 4 soils are poorly suited, and grade 5 soils are very poorly suited. In grade 6 are soils and miscellaneous areas that are not suited to farming.

Estimated Yields and Crop Management [3]

This section describes management that is necessary to obtain the yields shown in table 2. Management and estimated yields are based on observations made by the Soil Conservation Service and the University of California Agricultural Extension Service, and from the Agricultural Commissioner's Annual report for Orange County. They are also based on current technology and plant varieties. New developments in plant breeding, insect and disease control, irrigation methods, and other forms of management will eventually require revision of suggested practices and predicted yields.

The estimates shown in table 2 are averages that can be expected over a period of years. In any given year, yields may be considerably higher or lower than the average. If little or no information was available on yields of a given crop on a particular soil, estimates were made by comparing this soil with similar soils for which yield information was available. No estimates are given for miscellaneous areas, or for soils not considered suitable, or generally not used for any crops listed. Table 2 shows only the crops that are most extensively grown or that are highest in cash value.

On the following pages, the general management needed for each crop listed in table 2 is described.

All requirements for plant nutrients are for the elemental form; for example, pounds per acre of the element phosphorus. The gross irrigation use is the total annual plant need per acre less the average effective precipitation. Yearly and seasonal climatic variations greatly affect total water requirements and irrigation frequencies of listed crops.

It is assumed that the yields listed in table 2 were obtained under the optimum level of management. The optimum or best level of management known is that level which, according to experience, field trials, and research findings, would give the highest possible returns, and is within the capabilities of most farmers and ranchers in the survey area. This includes planting the best adapted and most desirable crop varieties and tilling, planting, fertilizing, pruning, thinning, irrigating, and harvesting at proper times and in adequate amounts. Specific recommendations on the kind and amount of fertilizer to apply, irrigation water management, suitable varieties, herbicide and insecticide use, and other production information can be obtained from the local Soil Conservation Service or the Agricultural Extension Service.

Asparagus

Asparagus can be planted by direct seeding or crown transplanting (fig. 4). Rows are spaced 5 feet apart. The variety now used is UC 72. Planting is in March or April and harvesting is from February to July. Harvest is by hand every 1 to 3 days, depending on weather. Medium textured to fine textured soils are preferable. About 2 to 3 acre-feet of water are applied. From 400 to 800 cubic feet of chicken manure is applied either before or after harvest. An additional 200 to 250 pounds of nitrogen is water run for sidedressings during fern growth. In fall or winter, the fern is cut and incorporated into the beds. A herbicide is applied before harvest to control weeds.

Avocados

Three varieties of avocado are presently used in commercial plantings, the Hass, the Fuerete, and the Bacon. The Hass variety consistently produces larger quantities of high quality fruit that is picked from April to August but is the least tolerant of low temperatures. The Fuerete produces high quality fruit that is picked from November to April but has an erratic bearing habit, partly because it requires cross pollination. The Bacon produces lower quality fruit that is picked from November to February and is often used in areas of cold climate because of its tolerance. It is also used as windbreaks because of its tall, upright growth.

A typical Hass-Fuerete planting is 124 trees per acre on a 16 by 22 foot area. Every other tree will be pulled 8 years after planting.

Most widely used rootstocks are of Mexican varieties, such as Topa Topa, Ganter, Mexicola, and others. Rootstocks that are tolerant of avocado root rot fungus (*Phytophthora cinnamomi*) are being investigated. Rootstocks of the Guatemalan variety are not suited to most soils in Orange County because of their susceptibility to chlorosis. Soils that are somewhat poorly drained or slowly or very slowly permeable in the subsoil should be avoided because the fungus-causing root rot is associated with wetness. There is no cure after the trees are infected.

Production of fruit generally starts during the fourth year after field planting, and peak production occurs between the 10th and 18th year of age. Orchard life expectancy (between 15 and 40 years) is determined more by risk of root rot disease than by all other factors combined. Because of the shallow rooting characteristic of the avocado, there is no cultivation, thus permitting the fallen leaves to form a mulch under the trees.

Irrigation water 2½ to 3½ feet deep, containing less than 75 to 100 parts per million (ppm) chloride, 50 percent exchangeable sodium, and 800 or 900 ppm total dissolved salts is used annually.

Furrows, sprinklers, and drip systems are the methods of irrigation. Leaching is required occasionally to remove salts from the root zone.

Nitrogen fertilization is required at the rate of 100 to 200 pounds per acre per year, applied in January or February for all varieties except Hass. For Hass, it is applied half in January and February and half in June. Zinc foliar sprays are sometimes required for soils that are deficient in zinc.

Insect and mite control is maintained by biological methods. No insecticides are applied.

Annual leaf analysis and tensiometers are the modern techniques for soil moisture and nutrition level control.

Celery

Celery is transplanted from August to April, and it is harvested by hand once over from November to June. Fieldwork includes disking the previous crop, subsoiling twice, plowing, landplaning, pre-irrigation,

[3] HAROLD W. OTTO and T. A. HALES, farm advisors, Cooperative Extension Service, University of California, provided technical information.

TABLE 2.—*Yields per acre of principal crops*

[Estimates are only soils that are widely used for crops listed. Absence of data indicates crops not significant]

Soil name and map symbol	Oranges, Valencia	Avocados	Asparagus	Celery	Straw-berries	Sweet corn	Tomatoes
	50-lb box	*Ton*	*Ton*	*Ton*	*Ton*	*Ton*	*Ton*
Alo:							
100	400						
101	350						
Alo Variant:							
103	400						
104	350						
Bolsa:							
122, 124				27		4.5	22
123, 125				30		5.0	26
Bosanko:							
126	400						
127, 129	350						
Botella:							
131	500	3.0		30		5.5	24
132	500	3.0		30		5.5	26
133	500	3.0					
Capistrano:							
135	500	3.0				5.5	26
136	500	3.0					
Chino:							
139				27		5.0	22
140			3.0	30		5.5	26
Corralitos:							
146, 147	450	2.5			23	4.5	20
Cropley:							
148, 149	400			27		5.0	24
Garretson:							
155	450	2.5					
Hanford:							
156	400	2.5					
Hueneme:							
157				25		4.5	22
158				27		5.0	24
Metz:							
163, 164	450	2.5			23	4.5	20
Mocho:							
165	600	3.0	2.5	30		5.0	24
166, 167	600	3.0	3.0	30		5.0	24
Modjeska:							
168, 169, 170	500	3.0					
171	450	2.5					
Myford:							
172, 173, 174	300						
176, 179	350						
Omni:							
182				27		5.0	26
183				25		4.5	22
184				27		5.0	24
Rincon:							
188, 189	500	2.5					
190	450						

TABLE 2.—*Yields per acre of principal crops*—Continued

Soil name and map symbol	Oranges, Valencia	Avocados	Asparagus	Celery	Strawberries	Sweet corn	Tomatoes
	50-lb box	*Ton*	*Ton*	*Ton*	*Ton*	*Ton*	*Ton*
San Andreas:							
193	350	2.5					
San Emigdio:							
194, 195	600	3.0	3.0	24	26	5.0	24
196	550			24	23	5.0	24
Soboba:							
197	350	2.5					
Sorrento:							
205, 206, 207, 208, 209	700	3.0	3.0	30		5.5	26
Thapto-Histic Fluvaquents:							
210				27		5.0	22

disking twice, renovation, furrowing out, and a second pre-irrigation just before transplanting. Medium textured to fine textured soils are preferred so that a relatively high moisture content can be maintained throughout the growing season and the occurrence of blackheart can be prevented. Varieties grown in the survey area are Utah 52–70—R–Strain and Calmario.

Six hundred cubic feet of chicken manure are applied before planting. About 110 pounds of phosphorus and 210 pounds of potassium are sidedressed in two applications, and 200 to 500 pounds of nitrogen are sidedressed in two applications. A herbicide is applied for weed control before or after transplanting. Single-hand hoeing is common. From 2 to 5 acre-feet of water is used in 8 to 15 applications. The amount used depends on the temperature.

About 375 flats, 100 plants per flat, are transplanted per acre. Rows are 24 to 26 inches apart. Celery is commonly sprayed for worms, leafhoppers, and Septoria blight. The 1-month rest period, in July, when no celery is left standing prevents western celery mosaic virus.

Oranges

Commercial production of citrus depends on proper site and variety selection. In Orange County, almost all oranges are Valencia. Site selection is not so critical as it is for avocados since the Valencia orange tolerates fine textured soils, for example, Alo soils, and is less sensitive to cold temperatures.

The number of trees planted per acre varies, but generally Valencia oranges are on 18- by 22-foot spacing with 110 trees per acre. Volunteer cover crops on hillside orchards are controlled by mowing.

Rootstock and scion selection are preventive measures for disease control. Rootstock varieties are selected for vigorous growth, cold resistance when mature, and some tolerance to nematodes and to brown rot gumosis and tristeza (quick decline). Such diseases as exocortis, a virus disease, are avoided by selection of virus free budwood.

Weeds are controlled by herbicides. Nitrogen fertilization, both soil and foliar applications, is required at the rate of 100 to 150 pounds per acre per year. Zinc and manganese sprays are also required in most areas on a regular basis. Occasionally there are potassium, magnesium, copper, and iron deficiencies.

Irrigation water is applied through furrows, sprinklers, and more recently, drip systems. Chlorosis (iron deficiency) on soils with a high lime content can be diminished by careful water management to prevent overirrigation. Generally, the more successful growers use the modern techniques, annual leaf analysis and tensiometers, in controlling levels of soil moisture and nutrition. About 3 acre-feet of water is applied per year.

Another modern technique used for pest management in citrus culture is called integrated pest control, where natural or imported pest predators are permitted to control insect pests. Conventional pest control has included chemical and oil spray applications for brown-soft scale, black scale, citrus thrips, citrus red mites, aphids, and mealybugs.

Strawberries

Preplant soil leveling and fumigation, transplanting, fertilization, irrigation, mulching, pruning, and weed control are needed for strawberries. Management varies with summer and winter plantings.

Land preparation consists of leveling to zero grade and forming furrows. Then the field is fumigated with methyl bromide-chloropicrin gas under sealed plastic tarping for 24 to 48 hours. Beds and furrows are then formed on 42- to 44-inch centers with 6-inch deep furrows (fig. 5).

Transplanting dates for summer plantings are through August; winter plantings are from October 20 to November 10. Plant densities for the 42- to 44-inch beds are nearly 23,000 plants per acre for summer plantings and 35,000 to 50,000 for winter plantings. The transplants are grown and imported from northern California nurseries. The varieties are Tioga and Tufts.

Harvesting of the winter planting can begin as early as the end of February. The advantage of early harvest of the winter planting is gained through the

Figure 4.—Asparagus on Mocho sandy loam, 0 to 2 percent slopes.

sacrifice of maximum total yield. Harvesting of some summer plantings will begin late in March.

Irrigation consists of sprinkling during the plant establishment periods and furrows after the application of plastic mulch in January. Frequency of irrigation during the harvesting season varies from 4 to 7 days. Total water used is 4 to 5 feet. Nitrogen is applied at the rate of 150 to 250 pounds per acre as preplant placement, as topdressing, or in irrigation water. Mites are controlled by spraying.

Sweet corn

Sweet corn is planted from about February 1 to August 1 and is harvested by hand or machine from July to October. Cultural practices include disking, plowing, disking twice, and pre-irrigation. Soils that range from sandy loam to clay are used for sweet corn. Ten pounds of seed per acre are planted in rows spaced 32 inches apart. Jubilee is the main variety in Orange County. Bonanza, another variety, is planted in areas where sugarcane mosaic disease is a problem.

About 22 to 32 pounds of phosphorus and 15 to 20 pounds of nitrogen generally are banded below the seed at planting. Then 100 pounds of nitrogen are sidedressed when plants are 1 foot tall. An additional 60 to 120 pounds of nitrogen is applied in water after plants begin to tassel.

About 2 acre-feet of water is applied in at least 3 or 4 irrigations. A herbicide can be used for weed control. Earworms are controlled by a pesticide spray every 2 or 3 days from the start of silking, for a total of five to seven sprayings.

Tomatoes

Tomatoes are normally seeded from February 1 to May. They are planted at the rate of ½- or ¾-pound of seed per acre. Canning tomatoes are harvested once by machine between July and October. Tomatoes grown for fresh market may be planted slightly earlier than those grown for processing and are transplanted under hot caps.

Cultivation consists of disking the previous crop, plowing, applying 300 to 400 cubic feet of chicken manure, disking twice, landplaning, disking again, spring tooth harrowing, cultipacking, forming beds, and cultivating beds. Varieties are strains of VF145, Cal J, VF315, VF134, and for fresh market, the H11 variety.

Medium textured to fine textured soils are preferred for tomatoes. Rows are spaced 5 feet apart. For can-

Figure 5.—Strawberries on San Emigdio fine sandy loam, 0 to 2 percent slopes.

ning tomatoes clumps of two to four plants are spaced 9 inches apart in the row. For fresh market tomatoes single plants are spaced 11 to 18 inches apart in the row, and stakes are placed between every other plant.

At thinning time, canning tomatoes are sidedressed with 100 pounds of nitrogen. Staked tomatoes receive 250 to 400 pounds of nitrogen applied throughout the season. From 2 to 3 acre-feet of water is applied in 3 to 7 applications depending on the soil and temperature.

Weeds are controlled with herbicides at planting time and then by cultivation and hand hoeing during the growing season. Worms and mites are controlled by spraying.

Range[4]

About 45 percent of the survey area, or 263,000 acres, is rangeland and wildland. This land has not been developed and is not used for agriculture. It has a native or natural plant cover. It is useful for livestock grazing, wildlife habitat, watershed protection, and outdoor recreation. The natural plant cover is dominated by a mixture of grasses, grasses and brush, brush, grasses and trees, or brush and trees.

This acreage does not include the poorly drained soils near the coast. The poorly drained soils are considered wetland, not rangeland.

Range sites

Range sites are kinds of rangeland that differ in the production of significantly different kinds or amounts of vegetation and in their capability to maintain a dynamic equilibrium with their environment unless they are seriously disturbed by overgrazing, fire, insects, or other damage. This grouping is useful for livestock management, brush management, and outdoor recreation management.

The rangeland of the survey area has been classified as eight range sites: Clayey, Shallow Clayey, Claypan, Loamy, Loamy-Rock outcrop complex, Shallow Loamy, Shallow Loamy-Rock outcrop complex, and Sandy.

For forage and wildlife habitat, plants can be classified as preferred, desirable, and undesirable. The preferred plants are the most palatable and nutritious. The desirable plants are somewhat less palatable but are readily grazed when high value plants are not available.

Animals graze selectively seeking the preferred plants. If grazing is not carefully regulated, the preferred plants are weakened or eliminated because they are not allowed to produce seed. Desirable plants then increase. If overgrazing continues, desirable plants are

[4] Prepared by IRVIN L. SEALANDER, range conservationist, Soil Conservation Service.

thinned out or eliminated and undesirable plants take their place or the soil is left bare. Similarly, preferred and desirable browse shrubs are thinned out or eliminated by heavy grazing, frequently with damage from wildfire.

The original vegetation was a mixture of perennial and annual plants. Now, most of the important herbaceous forage is introduced annuals from the Mediterranean region of Europe. These annuals grow during cool weather. They use the available soil moisture, produce seed, and mature before the moisture evaporates. They furnish highly nutritious forage in winter and spring when they are green and growing, but their nutritional value is low when they are mature.

Many species of the native shrubs are food plants for wildlife and livestock. Their principal growth also is in winter and spring, but they retain their nutritive value in summer and fall to a greater degree than the annuals.

Not considered in estimating the range site potential for kind or amount of vegetation is the influence of fire, which is a significant factor in the establishment and continuation of brush cover, particularly that of the chaparral plant community (6). This area has a continuous history of recurring wildfires. Most of the native brushy species generally regenerate from sprouts or seed and so continue to be dominated with brush cover. Field investigation indicates that chaparral matures in 50 to 75 years and tends to thin out unless it is reburned. Improving the range site potential in chaparral plant communities would require brush management and brush control.

Fire-induced chaparral is prevalent on most of the Loamy and Shallow Loamy sites, including the Rock-outcrop complexes. The Sandy, Claypan, and Shallow Clayey sites frequently have open to dense cover. The Clayey site is predominantly grass.

On the following pages each range site is described, the forage plants are named, and the total annual yield of herbage and of forage available to livestock is estimated for favorable and unfavorable years. The production for forage is not to be interpreted as usable forage. The estimates show the total yield in air-dry weight for sites that have not been treated with fertilizer. They are based on a limited number of plot clippings and on general knowledge of the sites. Extreme variations in weather can cause even greater annual fluctuations in yields.

CLAYEY RANGE SITE

Soils of the Alo, Balcom, Botella, Bosanko, Alo variant, Cropley, Gabino, Anaheim, Nacimiento, Rincon, and Sorrento series are in this site. The topography is nearly level or gently sloping to steep and in some areas very steep. Slopes are mainly 9 to 50 percent but range from 0 to 75 percent. Elevation is 25 to 2,500 feet. The mean annual precipitation is 10 to 20 inches.

These are clays and clay loams. Some are cobbly or stony. Rock outcrop occurs in some areas of Balcom soils. The soils are mostly 20 to 40 inches deep over sandstone and shale. A few are more than 60 inches deep. All are well drained. Available water capacity is 3.0 to 7.0 inches on upland soils and 8.0 to 13.0 inches on alluvial soils. The subsoil is slowly to moderately permeable. Runoff is slow to very rapid, and the erosion hazard is slight to very high, depending on slope.

This site has an open cover of grass. Some areas have scattered oak trees or shrubs. If the site is producing at potential, about 70 percent of the plant cover is wild oats, soft chess, burclover, filaree, and other preferred plants, including needlegrass and other remnant perennial grasses. Approximately 20 percent is ripgut brome, foxtail barley, and other desirable plants, and 10 percent is nitgrass, wild mustard, fiddleneck, and other undesirable plants. When the soil is moist late in spring, annual weeds make up more than 10 percent of the plant cover.

The estimated total annual yield is 2,400 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years. The estimated total annual yield available to livestock and wildlife is 2,000 pounds per acre in favorable years and 900 pounds per acre in unfavorable years. Because rock crops out on 10 to 20 percent of the surface area in the Balcom-Rock outcrop complex, yields are correspondingly lower.

Soils of this site are well suited to seeding with adapted annual grasses and legumes on slopes where a seedbed can be prepared. Seeding can increase in depleted areas two to four times. Fertilization can double production in years of high rainfall, but does not significantly increase production in years of low rainfall.

SHALLOW CLAYEY RANGE SITE

Soils of the Calleguas series are in this site. The topography is very steep. Slopes are 50 to 75 percent. Elevation ranges from 200 to 2,500 feet. The mean annual precipitation is 13 to 20 inches.

These are eroded clay loams on uplands. They are 10 to 19 inches deep over weathered lime-coated shale and sandstone. They are well drained. Available water capacity is 1.5 to 3.5 inches. The subsoil is moderately permeable. Runoff is rapid, and the erosion hazard is high.

The plant cover is open brush and an understory of grass. If this site is producing at potential, about 70 percent of the plant cover is wild oats, soft chess, burclover, filaree, and other preferred plants. Approximately 20 percent is foxtail barley, ripgut brome, and other desirable plants; and 10 percent is red brome, nitgrass, shrubs, and other undesirable plants. California sagebrush, California buckwheat, black sage, and ceanothus are the dominant shrubs.

The estimated total annual yield is 400 pounds per acre in favorable years and 50 pounds in unfavorable years. The estimated annual yield available to livestock is 150 pounds per acre in favorable years. No yields can be estimated in unfavorable years.

CLAYPAN RANGE SITE

Soils of the Chesterton, Myford, and Yorba series are in this site. The topography is nearly level and gently sloping to strongly sloping and steep. Slopes are mainly 0 to 15 percent but range to 50 percent. Elevation is 50 to 2,500 feet. The mean annual precipitation is 12 to 20 inches.

These soils are sandy loams and loamy sands. Some are gravelly or cobbly and have a sandy clay or very gravelly sandy clay loam subsoil. These soils are 5 to 30 inches deep over the very slowly or slowly permeable

subsoil. They are moderately well drained and well drained. Available water capacity is 1.0 to 5.5 inches. Runoff is slow to rapid, and the erosion hazard is slight to severe.

This site has an open cover of grass and scattered California buckwheat and California sagebrush. If it is producing at potential, about 70 percent of the plant cover is a mixture of wild oats, soft chess, filaree, burclover, and other preferred plants, including needlegrass and other remnant perennial grasses. Approximately 20 percent is ripgut brome, foxtail fescues, and other desirable plants; and not more than 10 percent is red brome, nitgrass, California sagebrush, California buckwheat, or other undesirable plants.

The estimated total annual yield is 1,500 pounds per acre in favorable years and 400 pounds per acre in unfavorable years. The estimated total annual yield available to livestock and wildlife is 1,300 pounds per acre in favorable years and 350 pounds per acre in unfavorable years.

All soils but mapping units 177, 225, and 226 are well suited to brush management and to seeding with adapted annual grasses and legumes. These practices increase production two to four times in depleted areas. Fertilization doubles production in years of high rainfall but does not significantly increase production in years of low rainfall.

LOAMY RANGE SITE

Soils of the Blasingame, Botella, Capistrano, Escondido, Anaheim, Las Posas, Laughlin, Mocho, Modjeska, Ramona, San Andreas, Soper, Sorrento, and Vista series are in this site. Nondeveloped and noncultivated Garretson and San Emigdio soils are also included. The topography is nearly level to very steep. Slopes are mainly 15 to 50 percent, but some are 0 to 75 percent. Elevation is 25 to 3,500 feet except for Laughlin gravelly loam where the elevation is 3,000 to 5,500 feet.

These are loams, sandy loams, very fine sandy loams, fine sandy loams, and coarse sandy loams. Some are gravelly, cobbly, or stony. Some are 20 to 40 inches deep over bedrock. Some, on alluvial fans and flood plains, are more than 60 inches deep in alluvium. All are well drained or moderately well drained. Available water capacity is 2.5 to 6.5 inches or 4.5 to 13.0 inches, depending on depth. Permeability is moderately slow to moderately rapid. Runoff is slow to very rapid, and the erosion hazard is slight to very high.

This site has a grass-brush or grass cover. If it is producing at potential, about 50 percent of the cover is ceanothus, California sagebrush, scrub oak, laurel sumac, sugar bush, chamise, California buckwheat, and other brushy plants; and 40 percent is soft chess, wild oats, filaree, needlegrass, and other preferred plants. No more than 10 percent is ripgut brome, red brome, foxtail fescue, nitgrass, annual weeds, and other desirable and undesirable plants.

At higher elevations the plant cover on Laughlin soils is an open to moderately dense stand of pines and oaks intermingled with open areas of grass and brush.

The estimated total annual yield is 1,800 pounds per acre in favorable years and 600 pounds per acre in unfavorable years. The estimated total annual yield available to livestock and wildlife is 1,200 pounds per acre in favorable years and 350 pounds per acre in unfavorable years.

On all soils but mapping units 110, 118, 159, 160, 202, 203, and 215, production is increased two to four times if brush is removed. Fertilization can increase production but generally not enough to justify the cost.

LOAMY-ROCK OUTCROP COMPLEX RANGE SITE

Soils of the Blasingame and Vista series intermingled with Rock outcrop are in this site. This site is similar to the Loamy range site, but 20 to 35 percent of the surface is covered with Rock outcrop or large boulders, slopes are 9 to 30 percent, runoff is rapid, and the erosion hazard is high.

The potential annual yield is 20 to 35 percent less than that on the Loamy range site because of the rock outcrops and boulders.

SHALLOW LOAMY RANGE SITE

Soils of the Cieneba, Exchequer, Friant, and Tollhouse series are in this site. Also included are some eroded Soper soils. The topography generally is steep to very steep. Slopes range from 9 to 75 percent. On only 5 percent of the site are slopes less than 30 percent. Elevation is mostly 200 to 4,000 feet. In a few places it is 5,000 feet.

These are sandy loams, gravelly silt loams, loams, and coarse sandy loams that are mostly 5 to 19 inches deep over fractured or weathered bedrock. Some are gravelly or stony. All are well drained to excessively drained. The subsoil is moderately to rapidly permeable. Available water capacity is 0.75 to 3.0 inches. Runoff is rapid, and the erosion hazard is high.

This site has a brush cover of chamise, California buckwheat, and California sagebrush along with small amounts of laurel sumac, sugar bush, ceanothus, and other species of chaparral. The herbaceous ground cover is generally sparse. If this site is producing at potential, approximately 70 percent of the understory is soft chess, wild oats, filaree, and other preferred plants. Approximately 20 percent is red brome, nitgrass, or undesirable plants.

The estimated total annual yield of air-dry forage ranges from 300 pounds per acre in favorable years to 100 pounds per acre in unfavorable years. The estimated annual yield available to livestock and wildlife ranges from 150 pounds per acre in favorable years. No yield can be estimated in unfavorable years.

SHALLOW LOAMY-ROCK OUTCROP COMPLEX RANGE SITE

Soils of the Cieneba, Exchequer, and Tollhouse series are in this site. Some eroded Soper soils intermingled with Rock outcrop are also included. This site is similar to the Shallow Loamy range site, but the surface area is 10 to 50 percent of Rock outcrop or large boulders.

The potential annual yield is 10 to 50 percent less than that of the Shallow Loamy range site because of the Rock outcrop and boulders.

SANDY RANGE SITE

Soils of the Corralitos, Hanford, Marina, Metz, and Soboba series are in this site. The topography is nearly level to strongly sloping. Slopes range from 0 to 15 percent. Elevation is 25 to 2,500 feet.

These are loamy sands or sandy loams on alluvial fans, flood plains, and terraces. They are more than 60 inches deep over stratified or sandy sediments. They are well drained to excessively drained and are moderately to very rapidly permeable. Runoff is slow to medium, and the erosion hazard is slight to moderate. Available water capacity is 2.0 to 9.0 inches.

Loamy sands that have a moderately fine substratum make up about 2 percent of this site. An intermittent water table is perched just above the substratum during some periods of above normal rainfall.

This site has an open cover of brush and a sparse to moderately dense understory of herbaceous plants. Trees and shrubs are abundant on some valley bottoms and flood plains. The brush cover is dense in some upland areas near the coast. If this site is producing at potential, approximately 50 percent of the plant cover is a mixture of soft chess, wild oats, filaree, and other preferred plants. No more than 20 percent is ripgut brome, red brome, nitgrass, and other desirable and undesirable plants. Approximately 30 percent is California sagebrush, sawtooth goldenbush, California buckwheat, and other shrubs.

The estimated total annual yield is 1,500 pounds per acre in favorable years and 300 pounds per acre in unfavorable years. The estimated total annual yield available to livestock and wildlife is 1,000 pounds per acre in favorable years and 225 pounds per acre in unfavorable years.

The soils of this site are suited to brush management and to seeding with adapted annual grasses and legumes. These practices can increase yields two to three times.

Wildlife Habitat [5]

Fish and wildlife provide opportunities for recreation and increase the quality of life in the survey area. They directly and indirectly affect the economy. They help in the natural control of insect pests, eliminate noxious weeds, and have a valuable role in outdoor recreation for birdwatchers, naturalists, and hunters. The habitat in the survey area is well suited to a variety of wildlife. The various kinds of wildlife are mentioned under the description of each habitat type.

Warmwater fish, such as black bass, catfish, and sunfish, inhabit the lakes and ponds in the survey area. Coldwater fish, such as trout, are stocked on a seasonal basis in some streams and larger lakes. Wildlife of particular interest are waterfowl and shore birds associated with the coastal wetlands (Type 18-Regularly Flooded Salt Marshes) (*8*). Seal Beach National Wildlife Refuge on Anaheim Bay, Upper Newport Bay, and Bolsa Chica marsh on Bolsa Bay, mapped as Tidal flats, are the prime areas where the vegetation, the soil, and the water are beneficial for wildlife. These areas are of high value to many birds, mammals, and marine vertebrates and invertebrates.

With other factors, such as climate, soils directly influence the kind and amount of vegetation and the amount of water available for the growth of habitat plantings. In this way soils indirectly influence the kinds and numbers of wildlife that can use an area.

[5] Prepared by RICHARD D. MCCABE, biologist, Soil Conservation Service.

The ratings for habitat elements and habitat types, which appear in table 3, mainly take into account soil characteristics and their potential for producing these habitat elements and types. The ratings do not account for closely related factors, such as the local climate, present use of soils, present distribution of wildlife and people, or land areas not classified as soils. For this reason, selection of a site for development of wildlife habitat often requires onsite investigation.

Many wildlife species, such as wetland wildlife, upland game birds, and song birds, require access to more than one habitat type. Most wildlife do well where habitat is interspersed and where the topography varies and provides edge effects and conditions that satisfy the various inherent needs of each species. Wetland wildlife requirements include a mixture of very shallow and deep water areas, some with open water and some with emergent and submergent vegetation.

Inventories and habitat considerations for the many reptiles, amphibians, bats, insects, and fish found in the survey area are not included. This omission does not imply that these more obscure forms of animal life are any less important than those which are included.

The major wildlife habitat types and representative kinds of permanent and transient wildlife species and major vegetation indigenous to the area are as follows:

Openland (farmland) habitat, cultivated cropland and irrigated pasture, is used by California quail, mourning dove, ring-necked pheasant, migratory waterfowl, band-tailed pigeon, raccoon, fox, and California mule deer. Irrigated citrus and avocado orchards have potential to attract many species of nongame birds as well as California quail and deer.

Woodland habitat is open to dense live oak intermingled with grassland and chaparral at lower elevations. Sycamore, cottonwood, alder, and live oak grow on many canyon bottoms.

At the higher elevations, oak is intermingled with conifers, mainly ponderosa pine and Jeffrey pine. This habitat is used by mourning dove, California quail, band-tailed pigeon, striped skunk, bobcat, California mule deer, coyote, badger, long-tailed weasel, and the mountain lion.

Wetland habitat has been mostly destroyed by urban and other developments. Continued destruction will reduce or eliminate wildlife, many of which are rare or endangered species.

This habitat includes the Type 18-Regularly Flooded Coastal Salt Marshes as well as the manmade freshwater impoundments and some rivers and streams. These wetlands produce plants of value to waterfowl and shore birds, for example, rushes, sedges, bulrushes, spartina, salicornia, and pondweed. Wildlife associated with these wetlands are migratory and resident ducks, migratory geese, shore birds, small nongame marsh birds, beaver, raccoon, and striped skunks. California legislation recognizes endangered and rare species, which include the lightfooted clapper rail, the beldings savannah sparrow, the black rail, the California least tern, and the brown pelican. There is a binding interrelationship between the rare and endangered species (*3, 4*) and the deteriorating Type 18 wetland.

Rangeland habitat is generally the unimproved pas-

ture and grassland often associated and intermingled with open or closed stands of chaparral (6), coastal sage scrub brush (6), and a few trees. Wildlife includes California quail, mourning dove, California mule deer, bobcat, mountain lion, coyote, and ground squirrel. Range site descriptions, located in local Soil Conservation Service offices, describe the soil, its location, and the relative production of grasses, forbs, and shrubs that influence the production of wildlife on range.

The suitability of a named soil to produce a given habitat type is shown in table 3.

Good habitat is easily improved, maintained, or created. There are few or no soil limitations in habitat management and satisfactory results can be expected. The soils are essentially well suited to the element of wildlife habitat.

Fair habitat can be improved, maintained, or created, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to ensure satisfactory results, even though the soil is suited to the element of wildlife habitat.

Poor habitat can be improved, maintained, or created, but soil limitations are severe. Habitat management may be difficult and expensive and requires intensive effort. Results are questionable because the soil is generally poorly suited to the element of wildlife habitat.

Very poor habitat is either impractical or impossible to attempt to improve, maintain, or create under the present soil conditions. Unsatisfactory results are probable because the soil is not suited to the element of wildlife habitat.

The wildlife habitat elements shown in table 3 are defined as follows:

Grain and seed crops are domestic grains, such as oats, barley, milo, Japanese millet, or other seed producing annuals, that provide food for wildlife.

Domestic grasses and legumes planted for wildlife cover and food are fescue, orchard grass, and annual and perennial ryegrass. The legumes are lana vetch, alfalfa, trefoil, and clover.

Wild herbaceous plants are native or naturally established dryland grasses and forbs that provide food and cover for wildlife. Burclover, dove weed, lupine, deervetch, wild oats, soft chess, and filaree are examples.

Hardwood trees include riparian vegetation and nonconiferous trees and associated woody understory plants that provide food or cover for wildlife. Examples are willow, alder, sycamore, elderberry, and oak trees.

Coniferous trees are cone-bearing trees, such as bigcone spruce, ponderosa pine, and Jeffrey pine.

Shrubs are woody plants that produce browse and mast (fruits and nuts) used by wildlife. Examples are chamise, manzanita, toyon, poison oak, ceanothus, scrub oak, California sagebrush, California buckwheat, sumac, encelia, and sawtooth goldenbush.

Wetland plants are domestic and wild annual and perennial herbaceous plants that provide food and cover. Examples are cattail, dock, sedges, plantain, saltgrass, smartweed, watergrass, Japanese millet, alkali bulrush, hardstem bulrush, spartina, salicornia, sea blite, and iodinebush.

Shallow water developments are low diked areas or naturally wet basins that provide shallow water, generally less than 5 feet deep, used by waterfowl. Examples are brackish and salt water marshes, wildlife watering developments, and ponds. Natural or manmade shallow water areas also provide habitat for fish and many wildlife species other than waterfowl. The suitability of soils for ponding water behind dams or levees is considered under the heading "Engineering."

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar

TABLE 3.—*Wildlife habitat*

[See text for definitions of "good," "fair," "poor," and "very poor."

Soil name and map symbol	Potential for habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants
Alo:					
100	Fair	Good	Poor		
101	Fair	Good	Poor		
102	Poor	Fair	Poor		
Alo Variant:					
103	Fair	Good	Poor		
104	Fair	Good	Poor		
105	Poor	Fair	Poor		
Anaheim:					
106, 108	Fair	Good	Poor		
107, 109	Poor	Fair	Poor		
110	Very poor	Very poor	Poor		
Balcom:					
111, 112	Fair	Good	Fair		
113	Poor	Fair	Fair		
[1] 114:					
Balcom part	Poor	Fair	Fair		
Rock outcrop part.					
Beaches:					
115.					
Blasingame:					
116	Fair	Good	Good	Good	Good
117	Poor	Poor	Good		
118	Very poor	Very poor	Good		
[1] 119:					
Blasingame part	Poor	Poor	Good	Good	Good
Rock outcrop part.					
Blasingame:					
[1] 120:					
Blasingame part	Fair	Good	Good		
Vista part	Fair	Good	Fair		
[1] 121:					
Blasingame part	Poor	Fair	Good		
Vista part	Poor	Fair	Fair		
Bolsa:					
122, 123 124, 125	Good	Good	Good		
Bosanko:					
126	Fair	Good	Poor		
127	Fair	Good	Poor		
128	Poor	Fair	Poor		
[1] 129:					
Bosanko part	Fair	Good	Poor		
Balcom part	Fair	Good	Fair		
[1] 130:					
Bosanko part	Poor	Fair	Poor		
Balcom part	Poor	Fair	Fair		
Botella:					
131, 132	Good	Good	Good		
133	Fair	Good	Good		
Calleguas:					
134	Very poor	Very poor	Fair		
Capistrano:					
135, 136	Fair	Good	Good		

potentials

Absence of an entry indicates the soil was not rated]

Potential for habitat elements—Cont.			Potential as habitat for—			
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Good	Very poor	Very poor	Good	Good	Very poor	Good.
Good	Very poor	Very poor	Fair		Very poor	Good.
Good	Very poor	Very poor	Poor		Very poor	Good.
Good	Very poor	Very poor	Poor	Good	Very poor	Good.
Good	Very poor	Very poor	Fair		Very poor	Good.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Good.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Good	Good	Fair	Good		Fair	Good.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Fair		Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Good	Poor	Very poor	Good		Very poor	Good.
Good	Very poor	Very poor	Good		Very poor	Good.
Fair	Very poor	Very poor	Very poor		Very poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Fair.

TABLE 3.—*Wildlife habitat*

Soil name and map symbol	Potential for habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants
Chesterton:					
137	Poor	Fair	Fair		
138	Poor	Fair	Fair		
Chino:					
139, 140	Good	Good	Good		
Cieneba:					
141	Poor	Fair	Poor		
142	Very poor	Very poor	Poor		
[1] 143:					
Cieneba part	Poor	Poor	Poor		
Blasingame part	Poor	Poor	Good	Good	Good
Rock outcrop part.					
[1] 144:					
Cieneba part	Poor	Poor	Poor		
Rock outcrop part.					
[1] 145:					
Cieneba part	Very poor	Very poor	Poor		
Rock outcrop part.					
Corralitos:					
146	Fair	Fair	Fair		
147	Good	Good	Good		
Cropley:					
148	Good	Good	Poor		
149	Good	Good	Poor		
Escondido:					
150	Fair	Good	Good		
151	Poor	Fair	Good		
Exchequer:					
[1] 152:					
Exchequer part	Very poor	Very poor	Poor	Very poor	
Rock outcrop part.					
Friant:					
153	Very poor	Very poor	Fair		
Gabino:					
154	Poor	Poor	Fair		
Garretson:					
155	Good	Good	Good		
Hanford:					
156	Good	Good	Good		
Hueneme:					
157	Good	Good	Good		
158	Good	Good	Good		
Las Posas:					
159	Very poor	Very poor	Fair		
Laughlin:					
160	Very poor	Very poor	Good		
Marina:					
161	Fair	Fair	Fair		
162	Poor	Poor	Fair		
Metz:					
163	Fair	Fair	Good		
164	Good	Good	Good		

potentials—Continued

Potential for habitat elements—Cont.			Potential as habitat for—			
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Good	Good	Good	Good		Good	Good.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Good	Very poor	Very poor	Poor	Good	Very poor	Good.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Poor	Very poor	Good		Very poor	Fair.
Poor	Poor	Fair	Good		Poor	Poor.
Poor	Poor	Very poor	Good		Very poor	Poor.
Good	Very poor	Very poor	Good		Very poor	Good.
Good	Very poor	Very poor	Fair		Very poor	Good.
Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Good	Poor	Poor	Good		Poor	Good.
Good	Poor	Very poor	Good		Very poor	Good.
Good	Good	Fair	Good		Fair	Good.
Good	Poor	Poor	Good		Poor	Good.
Very poor	Very poor	Very poor	Very poor		Very poor	Poor.
Good	Very poor	Very poor	Very poor		Very poor	Good.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Good.
Good	Very poor	Very poor	Good		Very poor	Good.

TABLE 3.—*Wildlife habitat*

Soil name and map symbol	Potential for habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants
Mocho:					
165, 166	Good	Good	Good		
167	Good	Good	Good		
Modjeska:					
168	Fair	Fair	Good		
169	Good	Good	Good		
170, 171	Fair	Good	Good		
Myford:					
172	Poor	Poor	Good		
173, 175, 179	Fair	Good	Good		
174	Poor	Fair	Good		
176	Poor	Fair	Good		
177	Very poor	Very poor	Fair		
178	Fair	Fair	Good		
Nacimiento:					
180	Fair	Good	Good		
181	Poor	Fair	Good		
Omni:					
182	Good	Good	Good		
183	Fair	Fair	Fair		
184	Good	Good	Good		
Pits:					
185.					
Ramona:					
186	Fair	Good	Fair		
187	Fair	Good	Fair		
Rincon:					
188	Good	Good	Fair		
189	Fair	Good	Fair		
190	Fair	Good	Fair		
Riverwash:					
191.					
Rock outcrop:					
[1] 192:					
Rock outcrop part.					
Cieneba part	Very poor	Very poor	Poor		
San Andreas:					
193	Poor	Fair	Good		
San Emigdio:					
194, 196	Good	Good	Good		
195	Good	Good	Good		
Soboba:					
197, 198	Poor	Poor	Poor		
Soper:					
199	Fair	Good	Fair		
200, 201	Poor	Fair	Fair		
202, 203	Very poor	Very poor	Fair		
[1] 204:					
Soper part	Very poor	Very poor	Fair		
Rock outcrop part.					
Sorrento:					
205, 206, 208	Good	Good	Good		
207, 209	Good	Good	Good		

potentials—Continued

Potential for habitat elements—Cont.			Potential as habitat for—			
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Good	Good	Good	Good		Good	
Good	Poor	Very poor	Good		Very poor	
Good	Poor	Very poor	Fair		Very poor	Good.
Good	Poor	Very poor	Good		Very poor	Good.
Good	Very poor	Very poor	Fair		Very poor	Good.
Poor	Poor	Poor	Fair		Poor	Fair.
Poor	Poor	Very poor	Fair		Very poor	Fair.
Poor	Poor	Very poor	Poor		Very poor	Fair.
Poor	Very poor	Very poor	Poor		Very poor	Fair.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Poor	Poor	Poor	Fair		Poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Good.
Good	Very poor	Very poor	Fair		Very poor	Good.
Good	Poor	Poor	Good		Poor	Good.
Poor	Fair	Fair	Fair		Fair	Poor.
Poor	Poor	Poor	Good		Poor	Fair.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Good	Poor	Very poor	Good		Poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Fair.
Good	Very poor	Very poor	Fair		Very poor	Fair.
Poor	Very poor	Very poor	Very poor		Very poor	Poor.
Good	Very poor	Very poor	Fair		Very poor	Good.
Good	Poor	Poor	Good		Poor	Good.
Good	Very poor	Very poor	Good		Very poor	Good.
Poor	Very poor	Very poor	Poor		Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Very poor		Very poor	Fair.
Fair	Very poor	Very poor	Very poor		Very poor	Fair.
Good	Good	Fair	Good		Fair	
Good	Poor	Very poor	Good		Very poor	

TABLE 3.—*Wildlife habitat*

Soil name and map symbol	Potential for habitat elements				
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants
Thapto-Histic Fluvaquents: 210	Fair	Fair	Fair		
Tidal flats: 211.					
Tollhouse: [1]212: Tollhouse part	Very poor	Very poor	Poor	Very poor	Very poor
Rock outcrop part.					
Vista: 213	Poor	Fair	Fair		
214	Poor	Fair	Fair		
215	Very poor	Very poor	Fair		
[1]216: Vista part	Poor	Poor	Fair		
Rock outcrop part.					
Xeralfic Arents: 217, 218	Fair	Fair	Good		
Xerorthents: 219, 220	Very poor	Very poor	Good		
Yorba: 221, 222, 223	Poor	Fair	Fair		
224	Poor	Poor	Fair		
225, 226	Very poor	Very poor	Fair		

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 4 shows, for each kind of soil, the degree and kind of limitations for building site development; table 5 for sanitary facilities; and table 7 for water management. Table 6 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 4. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings

potentials—Continued

Potential for habitat elements—Cont.			Potential as habitat for—			
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Fair	Fair	Good	Fair		Fair	Fair.
Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor.
Fair	Very poor	Very poor	Fair		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Fair	Very poor	Very poor	Very poor		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Good	Poor	Very poor	Fair		Very poor	Good.
Good	Very poor	Very poor	Very poor		Very poor	Good.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Fair	Very poor	Very poor	Poor		Very poor	Fair.
Fair	Very poor	Very poor	Very poor		Very poor	Fair.

behavior of the whole mapping unit.

do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 4 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 4 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 5 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover

TABLE 4.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
Alo:				
100	Severe: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength.
101, 102	Severe: too clayey, depth to rock, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.
Alo Variant:				
103	Severe: too clayey, depth to rock.	Severe: shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: shrink-swell, low strength.
104, 105	Severe: slope, too clayey, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Anaheim:				
106, 107, 108, 109, 110	Severe: slope	Severe: slope	Severe: slope	Severe: slope, low strength.
Balcom:				
111	Severe: depth to rock	Moderate: slope, depth to rock, low strength.	Severe: slope	Moderate: slope, low strength, depth to rock.
112, 113	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
[1] 114:				
Balcom part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	Severe: slope	Severe: slope	Severe: slope	Severe: low strength, slope.
117	Severe: large stones	Severe: large stones	Severe: slope, large stones.	Severe: low strength, large stones.
118	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, low strength.
Blasingame:				
[1] 119:				
Blasingame part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: low strength, slope.
Rock outcrop part.				
[1] 120:				
Blasingame part	Severe: large stones	Severe: large stones	Severe: slope, large stones.	Severe: low strength, large stones.
Vista part	Moderate: slope, depth to rock.	Moderate: slope	Severe: slope	Moderate: slope.
[1] 121:				
Blasingame part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, low strength, large stones.
Vista part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
Bolsa: 122, 123	Moderate: wetness, floods.	Severe: floods	Severe: floods	Moderate: floods, low strength, wetness.
124, 125	Moderate: floods	Severe: floods	Severe: floods	Moderate: floods, low strength, shrink-swell.
Bosanko: 126	Severe: too clayey	Severe: shrink-swell	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
127, 128	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
[1] 129, 130: Bosanko part	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, slope, shrink-swell.
Balcom part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
Botella: 131	Slight	Moderate: low strength.	Moderate: slope, low strength.	Severe: low strength.
132	Moderate: too clayey	Moderate: low strength.	Moderate: slope, low strength.	Severe: low strength.
Botella: 133	Moderate: slope, too clayey.	Moderate: slope, low strength.	Severe: slope	Severe: low strength.
Calleguas: 134	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Capistrano: 135	Slight	Slight	Moderate: slope	Moderate: low strength.
136	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, low strength.
Chesterton: 137	Moderate: too clayey, cemented pan.	Moderate: slope, low strength, shrink-swell.	Severe: slope	Severe: low strength.
138	Severe: slope	Severe: slope	Severe: slope	Severe: slope, low strength.
Chino: 139	Moderate: wetness, too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
140	Moderate: too clayey	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Cieneba: 141, 142	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
[1] 143: Cieneba part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
Blasingame part	Severe: slope	Severe: slope	Severe: slope	Severe: low strength, slope.
Rock outcrop part.				
[1] 144: Cieneba part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
[1] 145: Cieneba part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Corralitos: 146, 147	Severe: cutbanks cave.	Slight	Slight	Slight.
Cropley: 148, 149	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Escondido: 150	Moderate: slope, depth to rock.	Moderate: slope, low strength.	Severe: slope	Moderate: slope, low strength.
15.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Exchequer: [1] 152: Exchequer part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Rock outcrop part.				
Friant: 153	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
Gabino: 154	Severe: slope	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Garretson: 155	Moderate: small stones.	Slight	Moderate: slope	Moderate: low strength.
Hanford: 156	Slight	Slight	Moderate: slope	Slight.
Hueneme: 157	Severe: wetness	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.
158	Slight	Slight	Slight	Slight.
Las Posas: 159	Severe: slope, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.
Laughlin: 160	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
Marina:				
161	Severe: too sandy	Slight	Slight	Slight.
162	Severe: too sandy	Slight	Moderate: slope	Slight.
Metz:				
163, 164	Severe: cutbanks cave.	Slight	Slight	Slight.
Mocho:				
165, 166	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
167	Slight	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
Modjeska:				
168	Severe: small stones, cutbanks cave.	Slight	Slight	Slight.
169	Severe: small stones, cutbanks cave.	Slight	Moderate: slope	Slight.
170	Severe: small stones, cutbanks cave.	Moderate: slope	Severe: slope	Moderate: slope.
171	Severe: small stones, cutbanks cave, slope.	Severe: slope	Severe: slope	Severe: slope.
Myford:				
172, 173, 174, 178, 179	Moderate: too clayey	Severe: shrink-swell	Severe: shrink-swell	Severe: shrink-swell, low strength.
175	Moderate: too clayey	Severe: shrink-swell	Severe: slope, shrink-swell.	Severe: shrink-swell, low strength.
176, 177	Severe: slope	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, low strength.
Nacimiento:				
180, 181	Severe: slope	Severe: slope	Severe: slope	Severe: slope, low strength.
Omni:				
182, 183	Severe: too clayey	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
184	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.
Pits:				
185.				
Ramona:				
186	Slight	Slight	Moderate: slope	Moderate: low strength.
187	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope, low strength.
Rincon:				
188	Moderate: too clayey	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
189	Moderate: slope, too clayey.	Severe: low strength, shrink-swell.	Severe: slope, low strength. shrink-swell.	Severe: low strength, shrink-swell.
190	Severe: slope	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.
Riverwash: 191.				
Rock outcrop: [1] 192: Rock outcrop part.				
Cieneba part	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
San Andreas: 193	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
San Emigdio: 194, 196	Slight	Slight	Slight	Slight.
195	Slight	Slight	Moderate: slope	Slight.
Soboba: 197	Severe: small stones, cutbanks cave.	Slight	Slight	Slight.
198	Severe: small stones, cutbanks cave.	Moderate: slope	Severe: slope	Moderate: slope.
Soper: 199, 200, 201, 202, 203	Severe: slope	Severe: slope	Severe: slope	Severe: slope, low strength.
[1] 204: Soper part	Severe: slope	Severe: slope	Severe: slope	Severe: slope, low strength.
Rock outcrop part.				
Sorrento: 205, 206 208	Moderate: too clayey	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: low strength.
207, 209	Moderate: too clayey	Moderate: low strength, shrink-swell.	Moderate: slope, low strength, shrink-swell.	Severe: low strength.
Thapto-Histic Fluvaquents: 210	Severe: wetness, excess humus.	Severe: excess humus, wetness, low strength.	Severe: wetness, excess humus, low strength.	Severe: wetness, excess humus, low strength.
Tidal flats: 211.				
Tollhouse: [1] 212: Tollhouse part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Vista: 213	Moderate: slope, depth to rock.	Moderate: slope	Severe: slope	Moderate: slope.
214, 215	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 4.—*Building site development*—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Small commercial buildings	Local roads and streets
[1]216: Vista part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Xeralfic Arents: 217	Slight	Slight	Moderate: slope	Slight.
218	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
Xerorthents: 219	Severe: depth to rock	Moderate: slope, depth to rock.	Severe: slope	Moderate: slope.
220	Severe: slope, depth to rock.	Severe: slope	Severe: slope	Severe: slope.
Yorba: 221	Severe: small stones	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
222	Severe: small stones	Moderate: slope, shrink-swell.	Severe: slope	Moderate: slope, low strength, shrink-swell.
Yorba: 223, 224, 225, 226	Severe: slope, small stones.	Severe: slope	Severe: slope	Severe: slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight,* soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe,* soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good, fair,* or *poor,* which, respectively, mean about the same as the terms *slight, moderate,* and *severe.*

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid

TABLE 5.—*Sanitary facilities*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Alo:				
100	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Poor: too clayey, hard to pack.
101	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Poor: too clayey, hard to pack, slope.
102	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, slope.	Poor: too clayey, hard to pack, slope.
Alo Variant:				
103	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Poor: too clayey, hard to pack.
104	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Poor: slope, too clayey, hard to pack.
105	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, too clayey, depth to rock.	Poor: slope, too clayey, hard to pack.
Anaheim:				
106, 108	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope, depth to rock.	Poor: slope.
107, 109, 110	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope.
Balcom:				
111	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Fair: slope, thin layer, too clayey.
112	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope.
113	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope.
[1] 114:				
Balcom part	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope.
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	Severe: slope, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope.
117	Severe: percs slowly, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Poor: large stones.
118	Severe: slope, percs slowly, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Poor: slope, large stones.
[1] 119:				
Blasingame part	Severe: slope, percs slowly, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Poor: slope, large stones.
Rock outcrop part.				
[1] 120:				
Blasingame part	Severe: percs slowly, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Poor: large stones.

TABLE 5.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Vista part	Severe: depth to rock	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Fair: slope, thin layer.
[1] 121:				
Blasingame part	Severe: slope, percs slowly, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Poor: slope, large stones.
Vista part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: slope.
Bolsa:				
122	Severe: percs slowly, wetness.	Moderate: wetness	Severe: wetness	Good.
123	Severe: percs slowly	Slight	Moderate: floods	Good.
124	Severe: percs slowly, wetness.	Moderate: wetness	Severe: wetness	Fair: too clayey.
125	Severe: percs slowly	Slight	Moderate: floods	Fair: too clayey.
Bosanko:				
126	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey	Poor: too clayey.
127	Severe: percs slowly, depth to rock, slope.	Severe: slope, depth to rock.	Severe: too clayey	Poor: too clayey, slope.
128	Severe: percs slowly, depth to rock, slope.	Severe: slope, depth to rock.	Severe: too clayey, slope.	Poor: too clayey, slope.
[1] 129:				
Bosanko part	Severe: percs slowly, depth to rock, slope.	Severe: slope, depth to rock.	Severe: too clayey	Poor: too clayey, slope.
Balcom part	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope.
[1] 130:				
Bosanko part	Severe: percs slowly, depth to rock, slope.	Severe: slope, depth to rock.	Severe: too clayey, slope.	Poor: too clayey, slope.
Balcom part	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope.
Botella:				
131	Severe: percs slowly	Moderate: slope, excess humus.	Moderate: too clayey.	Fair: too clayey.
132	Severe: percs slowly	Moderate: slope, excess humus.	Moderate: too clayey.	Fair: too clayey.
133	Severe: percs slowly	Severe: slope	Moderate: too clayey.	Fair: slope, too clayey.
Calleguas:				
134	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope	Poor: slope, thin layer.
Capistrano:				
135	Slight	Severe: seepage	Severe: seepage	Good.
136	Moderate: slope	Severe: seepage, slope.	Severe: seepage	Fair: slope.
Chesterton:				
137	Severe: cemented pan, percs slowly.	Severe: slope	Moderate: cemented pan, too clayey.	Fair: slope, thin layer, too clayey.
138	Severe: slope, cemented pan, percs slowly.	Severe: slope	Moderate: slope, cemented pan, too clayey.	Poor: slope.

TABLE 5.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Chino:				
139	Severe: wetness, percs slowly.	Moderate: wetness	Severe: wetness	Fair: too clayey.
140	Severe: percs slowly	Slight	Moderate: too clayey	Fair: too clayey.
Cieneba:				
141	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: slope, thin layer.
142	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, thin layer.
[1]143:				
Cieneba part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: slope, thin layer.
Blasingame part	Severe: slope, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope.
Rock outcrop part.				
[1]144:				
Cieneba part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: seepage, depth to rock.	Poor: slope, thin layer.
Rock outcrop part.				
[1]145:				
Cieneba part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, thin layer.
Rock outcrop part.				
Corralitos:				
146	Slight	Severe: seepage	Severe: seepage	Fair: too sandy.
147	Severe: wetness	Severe: seepage	Severe: seepage, wetness.	Fair: too sandy.
Cropley:				
148	Severe: percs slowly	Slight	Severe: too clayey	Poor: too clayey.
149	Severe: percs slowly	Moderate: slope	Severe: too clayey	Poor: too clayey.
Escondido:				
150	Severe: depth to rock	Severe: slope, depth to rock.	Moderate: depth to rock.	Fair: slope, thin layer.
151	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Moderate: slope, depth to rock.	Poor: slope.
Exchequer:				
[1]152:				
Exchequer part	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: thin layer, slope.
Rock outcrop part.				
Friant:				
153	Severe: slope, depth to rock.	Severe: depth to rock, slope, seepage.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Gabino:				
154	Severe: slope, percs slowly.	Severe: slope	Severe: slope, too clayey.	Poor: slope, too clayey.
Garretson:				
155	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Poor: small stones.

TABLE 5.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Hanford: 156	Slight	Severe: seepage	Severe: seepage	Good.
Hueneme: 157	Severe: wetness	Severe: seepage, floods, wetness.	Severe: wetness, seepage.	Poor: wetness.
158	Slight	Severe: seepage	Severe: seepage	Good.
Las Posas: 159	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: slope, too clayey.	Poor: slope, too clayey.
Laughlin: 160	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope.
Marina: 161	Slight	Moderate: seepage	Moderate: too sandy	Fair: too sandy.
162	Slight	Moderate: slope, seepage.	Moderate: too sandy	Fair: too sandy.
Metz: 163, 164	Slight	Severe: seepage	Severe: seepage	Fair: too sandy.
Mocho: 165, 166	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Good.
Mocho: 167	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Good.
Modjeska: 168, 169	Slight	Severe: seepage	Severe: seepage	Poor: small stones.
170	Moderate: slope	Severe: slope, seepage.	Severe: seepage	Poor: small stones.
171	Severe: slope	Severe: slope, seepage.	Severe: seepage	Poor: slope, small stones.
Myford: 172, 178	Severe: percs slowly	Slight	Moderate: too clayey	Fair: too clayey.
173, 174, 179	Severe: percs slowly	Moderate: slope	Moderate: too clayey	Fair: too clayey.
175	Severe: percs slowly	Severe: slope	Moderate: too clayey	Fair: too clayey, slope.
176, 177	Severe: slope, percs slowly.	Severe: slope	Moderate: too clayey	Poor: slope.
Nacimiento: 180	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope.
181	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Poor: slope.
Omni: 182, 184	Severe: percs slowly	Slight	Severe: too clayey	Poor: too clayey.
183	Severe: percs slowly, wetness.	Severe: wetness	Severe: wetness, too clayey.	Poor: wetness, too clayey.
Pits: 185.				

TABLE 5.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Ramona:				
186	Severe: percs slowly	Moderate: slope	Slight	Good.
187	Severe: percs slowly	Severe: slope	Slight	Fair: slope.
Rincon:				
188	Severe: percs slowly	Moderate: slope	Moderate: too clayey	Fair: too clayey.
189	Severe: percs slowly	Severe: slope	Moderate: too clayey	Fair: too clayey, slope.
Rincon:				
190	Severe: percs slowly, slope.	Severe: slope	Moderate: too clayey, slope.	Poor: slope.
Riverwash:				
191.				
Rock outcrop:				
[1] 192:				
Rock outcrop part.				
Cieneba part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, thin layer.
San Andreas:				
193	Severe: slope, depth to rock.	Severe: slope, seepage, depth to rock.	Severe: seepage, depth to rock.	Poor: slope.
San Emigdio:				
194, 195	Slight	Severe: seepage	Severe: seepage	Good.
196	Severe: percs slowly	Severe: seepage	Severe: seepage	Good.
Soboba:				
197	Slight	Severe: seepage	Severe: seepage, too sandy.	Poor: too sandy, small stones.
198	Moderate: slope	Severe: slope, seepage.	Severe: too sandy, seepage.	Poor: too sandy, small stones.
Soper:				
199, 201	Severe: slope, percs slowly, depth to rock.	Severe: slope	Moderate: slope, depth to rock.	Poor: slope.
200, 202, 203	Severe: slope, percs slowly, depth to rock.	Severe: slope	Severe: slope	Poor: slope.
[1] 204:				
Soper part	Severe: slope, percs slowly, depth to rock.	Severe: slope	Severe: slope	Poor: slope.
Rock outcrop part.				
Sorrento:				
205, 206, 207	Moderate: percs slowly.	Moderate: seepage	Moderate: too clayey	Fair: too clayey.
208, 209	Severe: percs slowly	Moderate: seepage, slope.	Moderate: too clayey	Fair: too clayey.
Thapto-Histic Fluvaquents:				
210	Severe: wetness, percs slowly.	Severe: wetness, excess humus.	Severe: wetness, excess humus, too clayey.	Poor: wetness, excess humus.
Tidal flats:				
211.				

TABLE 5.—*Sanitary facilities*—Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Daily cover for landfill
Tollhouse:				
[1] 212:				
Tollhouse part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Poor: slope, thin layer.
Rock outcrop part.				
Vista:				
213	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Fair: slope, thin layer.
214	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: slope.
215	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Poor: slope.
[1] 216:				
Vista part	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: slope.
Rock outcrop part.				
Xeralfic Arents:				
217	Severe: percs slowly	Moderate: slope	Slight	Good.
218	Severe: percs slowly	Severe: slope	Slight	Fair: slope.
Xerorthents:				
219	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: thin layer.
220	Severe: slope, depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock	Poor: slope, thin layer.
Yorba:				
221	Severe: percs slowly	Moderate: slope, small stones.	Moderate: too clayey	Poor: small stones.
222	Severe: percs slowly	Severe: slope	Moderate: too clayey	Poor: small stones.
Yorba:				
223, 224, 225	Severe: slope, percs slowly.	Severe: slope	Moderate: slope, too clayey.	Poor: slope, small stones.
226	Severe: slope, percs slowly.	Severe: slope	Severe: slope	Poor: slope, small stones.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 5

TABLE 6.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soils are not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Alo:				
100	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: too clayey.
101	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: too clayey, slope.
102	Poor: low strength, thin layer, slope.	Unsuited	Unsuited	Poor: too clayey, slope.
Alo Variant:				
103	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: too clayey.
104	Poor: shrink-swell, low strength, thin layer.	Unsuited	Unsuited	Poor: slope, too clayey.
105	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope, too clayey.
Anaheim:				
106, 108	Poor: low strength, slope.	Unsuited	Unsuited	Poor: slope.
107, 109, 110	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
Balcom:				
111	Poor: low strength, thin layer.	Unsuited	Unsuited	Fair: slope, too clayey.
112	Poor: low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
113	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
[1] 114:				
Balcom part	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	Poor: low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
117	Poor: thin layer, large stones, low strength.	Unsuited	Unsuited: large stones.	Poor: large stones.
118	Poor: slope, thin layer, large stones.	Unsuited	Unsuited: large stones.	Poor: slope, large stones.
[1] 119:				
Blasingame part	Poor: low strength, thin layer.	Unsuited	Unsuited: large stones.	Poor: slope.
Rock outcrop part.				
[1] 120:				
Blasingame part	Poor: thin layer, large stones, low strength.	Unsuited	Unsuited: large stones.	Poor: large stones.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Vista part	Good	Unsuited: thin layer	Unsuited	Fair: slope.
[1] 121: Blasingame part	Poor: thin layer, large stones, low strength.	Unsuited	Unsuited: large stones.	Poor: slope, large stones.
Vista part	Fair: slope	Unsuited: thin layer	Unsuited	Poor: slope.
Bolsa: 122	Fair: wetness, low strength, shrink-swell.	Unsuited	Unsuited	Good.
123	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Good.
124	Fair: wetness, low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
125	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Bosanko: 126	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey.
127	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey, slope.
Bosanko: 128	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey, slope.
[1] 129: Bosanko part	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey, slope.
Balcom part	Poor: low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
[1] 130: Bosanko part	Poor: slope, low strength, shrink-swell.	Unsuited	Unsuited	Poor: too clayey, slope.
Balcom part	Poor: slope, low strength, thin layer.	Unsuited	Unsuited	Poor: slope.
Botella: 131, 132	Poor: low strength	Unsuited	Unsuited	Fair: too clayey.
133	Poor: low strength	Unsuited	Unsuited	Fair: slope, too clayey.
Calleguas: 134	Poor: slope, thin layer.	Unsuited	Unsuited	Poor: slope.
Capistrano: 135	Fair: low strength	Poor: excess fines	Unsuited	Good.
136	Fair: low strength	Poor: excess fines	Unsuited	Fair: slope.
Chesterton: 137	Poor: low strength	Unsuited	Unsuited	Fair: slope.
138	Poor: low strength	Unsuited	Unsuited	Poor: slope.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Chino: 139, 140	Poor: low strength	Unsuited	Unsuited	Fair: too clayey.
Cieneba: 141	Poor: thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
142	Poor: slope, thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
[1] 143: Cieneba part	Poor: thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
Blasingame part	Poor: low strength, thin layer.	Unsuited	Unsuited	Poor: slope, thin layer.
Rock outcrop part.				
[1] 144: Cieneba part	Poor: thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
Rock outcrop part.				
[1] 145: Cieneba part	Poor: slope, thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
Rock outcrop part.				
Corralitos: 146, 147	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Cropley: 148, 149	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Escondido: 150	Fair: low strength	Unsuited	Unsuited	Fair: slope.
151	Fair: slope, low strength.	Unsuited	Unsuited	Poor: slope.
Exchequer: [1] 152: Exchequer part	Poor: slope, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited	Poor: slope, small stones, area reclaim.
Rock outcrop part.				
Friant: 153	Poor: slope, thin layer, area reclaim.	Poor: excess fines	Unsuited	Poor: slope, area reclaim.
Gabino: 154	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, small stones.
Garretson: 155	Fair: low strength	Unsuited	Unsuited	Poor: small stones.
Hanford: 156	Good	Poor: excess fines	Unsuited	Fair: small stones.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Hueneme: 157	Poor: wetness	Poor: excess fines	Unsuited	Poor: wetness.
158	Good	Poor: excess fines	Unsuited	Good.
Las Posas: 159	Poor: slope, shrink-swell, low strength.	Unsuited	Unsuited	Poor: slope, small stones.
Laughlin: 160	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope, small stones.
Marina: 161, 162	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Metz: 163, 164	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Mocho: 165, 166, 167	Fair: shrink-swell, low strength.	Unsuited	Unsuited	Fair: excess lime.
Modjeska: 168, 169, 170	Good	Unsuited	Fair: excess fines	Poor: small stones.
171	Fair: slope	Unsuited	Fair: excess fines	Poor: slope, small stones.
Myford: 172, 173, 174	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
175	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: slope, too clayey.
176, 177	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
178, 179	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Good.
Nacimiento: 180	Poor: low strength.	Unsuited	Unsuited	Poor: slope.
Nacimiento: 181	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope.
Omni: 182	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
183	Poor: wetness, shrink-swell, low strength.	Unsuited	Unsuited	Poor: wetness, too clayey.
184	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Pits: 185.				
Ramona: 186	Fair: low strength	Poor: excess fines	Unsuited	Fair: small stones.
187	Fair: low strength	Poor: excess fines	Unsuited	Poor: small stones.
Rincon: 188	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
189	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Fair: too clayey, slope.
190	Poor: low strength, shrink-swell.	Unsuited	Unsuited	Poor: slope.
Riverwash: 191.				
Rock outcrop: [1] 192: Rock outcrop part.				
Cieneba part	Poor: slope, thin layer, area reclaim.	Unsuited: thin layer	Unsuited	Poor: slope, thin layer, area reclaim.
San Andreas: 193	Poor: thin layer	Unsuited	Unsuited	Poor: slope.
San Emigdio: 194, 195, 196	Fair: low strength	Poor: excess fines	Unsuited	Good.
Soboba: 197	Good	Fair: excess fines	Fair: excess fines	Poor: small stones, too sandy.
198	Fair: slope	Fair: excess fines	Fair: excess fines	Poor: small stones, too sandy.
Soper: 199, 201	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope.
200, 202, 203	Poor: slope, low strength.	Unsuited	Unsuited	Poor: slope.
[1] 204: Soper part	Poor: low strength	Unsuited	Unsuited	Poor: slope.
Rock outcrop part.				
Sorrento: 205, 206, 207	Poor: low strength	Unsuited	Unsuited	Good.
208 209	Poor: low strength	Unsuited	Unsuited	Fair: too clayey.
Thapto-Histic Fluvaquents: 210	Poor: wetness, excess humus, low strength.	Unsuited	Unsuited	Poor: wetness.
Tidal flats: 211.				
Tollhouse: [1] 212: Tollhouse part	Poor: thin layer	Poor: excess fines	Poor: excess fines	Poor: slope.
Rock outcrop part.				
Vista: 213	Good	Unsuited: thin layer	Unsuited	Fair: slope.
214	Fair: slope	Unsuited: thin layer	Unsuited	Poor: slope.
215	Poor: slope	Unsuited: thin layer	Unsuited	Poor: slope.
[1] 216: Vista part	Fair: slope	Unsuited: thin layer	Unsuited	Poor: slope.
Rock outcrop part.				

TABLE 6.—*Construction materials*—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Xeralfic Arents:				
217	Good	Unsuited	Unsuited	Good.
218	Good	Unsuited	Unsuited	Fair: slope.
Xerorthents:				
219	Poor: thin layer	Unsuited	Unsuited	Fair: slope.
220	Poor: thin layer	Unsuited	Unsuited	Poor: slope.
Yorba:				
221, 222	Fair: low strength, shrink-swell.	Unsuited	Unsuited: excess fines.	Poor: small stones.
223, 224, 225	Fair: slope, low strength, shrink-swell.	Unsuited	Unsuited: excess fines.	Poor: slope, small stones.
226	Poor: slope	Unsuited	Unsuited: excess fines.	Poor: slope, small stones.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 6 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 9 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 6 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of min-

TABLE 7.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Alo: 100, 101, 102	Slope, depth to rock.	Low strength, thin layer, hard to pack.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.	Slope, percs slowly.
Alo Variant: 103, 104, 105	Slope, depth to rock.	Low strength, thin layer, hard to pack.	Slope, percs slowly, depth to rock.	Slope, percs slowly, depth to rock.	Slope, percs slowly.
Anaheim: 106, 107, 108, 109, 110	Slope, depth to rock.	Low strength, thin layer.	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Balcom: 111, 112, 113	Slope, depth to rock.	Low strength, thin layer, shrink-swell.	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
[1] 114: Balcom part	Slope, depth to rock.	Low strength, thin layer, shrink-swell.	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.					
Beaches: 115.					
Blasingame: 116	Slope, depth to rock.	Low strength, compressible, thin layer.	Slope, percs slowly, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
117, 118	Slope, depth to rock.	Large stones, low strength, thin layer.	Slope, percs slowly, depth to rock.	Slope, depth to rock, large stones.	Slope, large stones, rooting depth.
[1] 119: Blasingame part.	Slope, depth to rock.	Low strength, thin layer, large stones.	Slope, percs slowly, depth to rock.	Slope, depth to rock, large stones.	Slope, rooting depth, large stones.
Rock outcrop part.					
[1] 120: Blasingame part.	Slope, depth to rock.	Compressible, low strength, thin layer.	Slope, percs slowly, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Vista part	Slope, seepage.	Seepage, piping	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, droughty.
[1] 121: Blasingame part.	Slope, depth to rock.	Compressible, low strength, thin layer.	Slope, percs slowly, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Vista part	Slope, seepage.	Seepage, piping	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, droughty.
Bolsa: 122, 123	Percs slowly	Piping, low strength, wetness.	Wetness, percs slowly.	Percs slowly, piping.	Percs slowly, wetness.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
124, 125	Percs slowly	Piping, low strength.	Percs slowly	Percs slowly, piping.	Percs slowly.
Bosanko: 126, 127, 128	Slope, depth to rock.	Low strength, hard to pack, compressible.	Percs slowly, slope.	Slope, depth to rock, percs slowly.	Slope, percs slowly.
[1] 129: Bosanko part	Slope, depth to rock.	Low strength, hard to pack, compressible.	Percs slowly, slope.	Slope, depth to rock, percs slowly.	Slope, percs slowly.
Balcom part	Slope, depth to rock.	Low strength, thin layer, shrink-swell.	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
[1] 130: Bosanko part	Slope, depth to rock.	Low strength, hard to pack, compressible.	Percs slowly, slope.	Slope, depth to rock, percs slowly.	Slope, percs slowly.
Balcom part	Slope, depth to rock.	Low strength, thin layer, shrink-swell.	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Botella: 131, 132, 133	Slope, excess humus.	Low strength	Complex slope, percs slowly.	Complex slope, percs slowly.	Complex slope, percs slowly.
Calleguas: 134	Slope, depth to rock.	Thin layer, low strength.	Complex slope, depth to rock.	Complex slope, depth to rock.	Complex slope, rooting depth.
Capistrano: 135, 136	Seepage	Piping, low strength.	Complex slope, seepage.	Complex slope, piping.	Complex slope, piping.
Chesterton: 137, 138	Cemented pan, slope.	Low strength, thin layer.	Cemented pan, percs slowly, slope.	Cemented pan, slope, percs slowly.	Slope, percs slowly, rooting depth.
Chino: 139	Favorable	Shrink-swell, low strength, compressible.	Wetness, percs slowly, excess salt.	Percs slowly, wetness.	Percs slowly, wetness, excess salt.
140	Favorable	Shrink-swell, low strength, compressible.	Percs slowly	Percs slowly	Percs slowly.
Cieneba: 141, 142	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth, droughty.
[1] 143: Cieneba part	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth, droughty.
Blasingame part	Slope, depth to rock.	Low strength, compressible, thin layer.	Slope, percs slowly, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.					

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
[1] 144: Cieneba part	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth, droughty.
Rock outcrop part.					
[1] 145: Cieneba part	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth, droughty.
Rock outcrop part.					
Corralitos: 146	Seepage, slope	Seepage, piping	Slope	Slope, piping.	Slope, droughty.
147	Seepage, slope	Seepage, piping	Slope, percs slowly, wetness.	Slope, piping, percs slowly.	Slope, droughty.
Cropley: 148	Favorable	Low strength, compressible, hard to pack.	Percs slowly	Percs slowly	Percs slowly, slope.
149	Slope	Low strength, compressible, hard to pack.	Percs slowly, slope.	Percs slowly	Percs slowly, slope.
Escondido: 150, 151	Slope, depth to rock.	Thin layer, low strength, piping.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth.
Exchequer: [1] 152: Exchequer part	Slope, depth to rock.	Thin layer	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Rock outcrop part.					
Friant: 153	Depth to rock, slope, seepage.	Thin layer, low strength, piping.	Complex slope, depth to rock.	Complex slope, depth to rock, piping.	Complex slope, rooting depth.
Gabino: 154	Slope	Shrink-swell, low strength, piping.	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Garretson: 155	Seepage, slope	Low strength	Slope	Slope	Slope.
Hanford: 156	Slope, seepage	Piping	Slope	Piping	Slope, droughty.
Hueneme: 157	Seepage	Piping	Wetness	Poor outlets, piping.	Wetness.
Hueneme: 158	Seepage	Piping	Favorable	Poor outlets, piping.	Favorable.
Las Posas: 159	Slope, depth to rock.	Low strength, shrink-swell.	Slope, percs slowly.	Depth to rock, slope.	Slope, percs slowly, rooting depth.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Laughlin: 160	Slope, depth to rock.	Depth to rock, low strength, hard to pack.	Slope, depth to rock.	Slope	Slope, rooting depth.
Marina: 161	Seepage	Seepage	Favorable	Too sandy, soil blowing.	Droughty.
162	Seepage, slope	Seepage	Slope	Too sandy, soil blowing.	Droughty.
Metz: 163, 164	Seepage	Piping, seepage	Cutbanks cave	Too sandy, piping, erodes easily.	Droughty, erodes easily.
Mocho: 165, 166	Seepage	Low strength, compressible, hard to pack.	Favorable	Favorable	Favorable.
167	Slope, seepage	Low strength, compressible, hard to pack.	Slope	Favorable	Favorable.
Modjeska: 168	Seepage, slope	Seepage, piping	Cutbanks cave	Piping	Droughty.
169	Seepage, slope	Seepage, piping	Slope, cutbanks cave.	Piping	Droughty.
170, 171	Seepage, slope	Seepage, piping	Slope, cutbanks cave.	Slope, piping	Slope, droughty.
Myford: 172, 178	Favorable	Low strength, hard to pack, compressible.	Percs slowly	Percs slowly	Percs slowly.
173, 174, 179	Slope	Low strength, hard to pack, compressible.	Slope, percs slowly.	Percs slowly	Percs slowly.
175, 176, 177	Slope	Low strength, hard to pack, compressible.	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
Nacimiento: 180, 181	Slope, depth to rock.	Low strength, hard to pack, thin layer.	Complex slope, percs slowly, depth to rock.	Complex slope, percs slowly, depth to rock.	Slope, percs slowly, rooting depth.
Omni: 182, 184	Favorable	Compressible, low strength, shrink-swell.	Percs slowly, poor outlets.	Poor outlets, percs slowly.	Percs slowly.
183	Favorable	Compressible, low strength, shrink-swell.	Wetness, poor outlets, percs slowly.	Wetness, poor outlets, percs slowly.	Wetness, percs slowly.
Pits: 185.					
Ramona: 186	Slope	Piping	Slope, percs slowly.	Percs slowly, piping.	Percs slowly.
187	Slope	Piping	Slope, percs slowly.	Percs slowly, slope, piping.	Slope, percs slowly.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Rincon: 188, 189, 190	Slope	Low strength, compressible, hard to pack.	Complex slope, percs slowly.	Percs slowly, complex slope.	Percs slowly, complex slope.
Riverwash: 191.					
Rock outcrop: [1] 192: Rock outcrop part.					
Cieneba part	Slope, depth to rock, seepage.	Piping, thin layer.	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, rooting depth, droughty.
San Andreas: 193	Slope, seepage, depth to rock.	Low strength, piping, hard to pack.	Slope, depth to rock.	Slope, piping, depth to rock.	Slope, rooting depth.
San Emigdio: 194	Seepage, slope	Piping	Favorable	Not needed	Favorable.
195	Seepage, slope	Piping	Slope	Piping	Favorable.
196	Seepage	Piping	Percs slowly	Piping, percs slowly.	Percs slowly.
Soboba: 197	Slope, seepage	Seepage	Slope	Too sandy, erodes easily.	Droughty, erodes easily.
198	Slope, seepage	Seepage	Slope	Too sandy, erodes easily, slope.	Droughty, slope, erodes easily.
Soper: 199, 200, 201, 202, 203	Slope	Low strength, piping, hard to pack.	Slope	Slope	Slope.
[1] 204: Soper part	Slope	Low strength, piping, hard to pack.	Slope	Slope	Slope.
Rock outcrop part.					
Sorrento: 205, 206	Seepage	Low strength, piping, hard to pack.	Favorable	Piping	Favorable.
Sorrento: 207	Slope, seepage	Low strength, piping, hard to pack.	Slope	Piping	Favorable.
208	Favorable	Low strength, compressible.	Favorable	Favorable	Percs slowly.
209	Slope	Low strength, compressible.	Slope	Favorable	Percs slowly.
Thapto-Histic Fluvaquents: 210	Seepage	Low strength, hard to pack, compressible.	Wetness	Wetness	Wetness.

TABLE 7.—*Water management*—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Tidal flats: 211.					
Tollhouse: [1] 212: Tollhouse part	Slope, seepage, depth to rock.	Thin layer, seepage.	Slope, depth to rock.	Depth to rock, slope.	Rooting depth, slope.
Rock outcrop part.					
Vista: 213, 214, 215	Slope, seepage	Seepage, piping	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, droughty.
[1] 216: Vista part	Slope, seepage	Seepage, piping	Slope, depth to rock.	Slope, depth to rock, piping.	Slope, droughty.
Rock outcrop part.					
Xeralfic Arents: 217	Slope	Low strength	Slope	Favorable	Favorable.
218	Slope	Low strength	Slope	Slope	Slope.
Xerorthents: 219, 220	Slope	Thin layer	Slope, depth to rock.	Slope, depth to rock.	Slope, rooting depth.
Yorba: 221	Slope	Low strength	Slope, percs slowly.	Percs slowly	Percs slowly.
222, 223, 224, 225, 226	Slope	Low strength	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

erals, reaction, and stratification are given in the soil series descriptions and in table 9.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 7 the degree of soil limitation and soil and site features that affect use are indicated

TABLE 8.—*Recreational development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Alo:				
100	Severe: too clayey	Severe: too clayey	Severe: too clayey, slope.	Severe: too clayey.
101	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey.
102	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.
Alo Variant:				
103	Severe: too clayey	Severe: too clayey	Severe: slope, too clayey.	Severe: too clayey.
104	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey.
105	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.
Anaheim:				
106, 108	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
107, 109, 110	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Balcom:				
111	Moderate: slope, too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: slope	Moderate: too clayey.
112	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, too clayey.
113	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] 114:				
Balcom part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
117	Severe: large stones, slope.	Moderate: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
118	Severe: slope, large stones.	Severe: slope	Severe: slope, large stones.	Severe: slope, large stones.
[1] 119:				
Blasingame part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
Rock outcrop part.				
[1] 120:				
Blasingame part	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Moderate: dusty.
Vista part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
[1] 121:				
Blasingame part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Vista part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Bolsa:				
122	Moderate: wetness, percs slowly.	Moderate: wetness	Severe: wetness	Moderate: wetness.

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
123	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
124	Moderate: percs slowly, too clayey, wetness.	Moderate: wetness, too clayey.	Severe: wetness	Moderate: wetness, too clayey.
125	Moderate: percs slowly too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
Bosanko: 126	Severe: too clayey	Severe: too clayey	Severe: too clayey, slope.	Severe: too clayey.
127	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey.
128	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.
[1] 129: Bosanko part	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey.
Balcom part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, too clayey.
[1] 130: Bosanko part	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.	Severe: too clayey, slope.
[1] 130: Balcom part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Botella: 131	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
132	Moderate: too clayey, percs slowly.	Moderate: too clayey	Moderate: slope, percs slowly.	Moderate: too clayey.
133	Moderate: slope, too clayey, percs slowly.	Moderate: slope, too clayey.	Severe: slope	Moderate: too clayey.
Calleguas: 134	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
Capistrano: 135	Slight	Slight	Moderate: slope	Slight.
136	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Chesterton: 137	Severe: percs slowly	Moderate: slope, too sandy.	Severe: slope, percs slowly.	Moderate: too sandy.
138	Severe: slope, percs slowly.	Severe: slope	Severe: slope, percs slowly.	Moderate: slope, too sandy.
Chino: 139	Moderate: wetness, too clayey, percs slowly.	Moderate: wetness, too clayey.	Moderate: wetness, percs slowly, too clayey.	Moderate: wetness, too clayey.
140	Moderate: too clayey, percs slowly.	Moderate: too clayey	Moderate: percs slowly.	Moderate: too clayey.
Cieneba: 141	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Moderate: slope.
142	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
[1] 143:				
Cieneba part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Moderate: slope.
Blasingame part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, dusty.
Rock outcrop part.				
[1] 144:				
Cieneba part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Moderate: slope.
Rock outcrop part.				
[1] 145:				
Cieneba part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop part.				
Corralitos:				
146, 147	Moderate: too sandy	Moderate: too sandy	Moderate: slope, too sandy.	Moderate: too sandy.
Cropley:				
148, 149	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Escondido:				
150	Moderate: slope	Moderate: slope	Severe: slope	Slight.
151	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Exchequer:				
[1] 152:				
Exchequer part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop part.				
Friant:				
153	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
Gabino:				
154	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Garretson:				
155	Moderate: small stones.	Moderate: small stones.	Moderate: small stones.	Moderate: small stones.
Hanford:				
156	Slight	Slight	Moderate: slope	Slight.
Hueneme:				
157	Severe: wetness, floods.	Severe: wetness	Severe: wetness	Severe: wetness.
158	Slight	Slight	Slight	Slight.
Las Posas:				
159	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Laughlin:				
160	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.
Marina:				
161	Moderate: too sandy	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
162	Moderate: too sandy	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Metz: 163, 164	Moderate: too sandy	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Mocho: 165, 166	Slight	Slight	Slight	Slight.
167	Slight	Slight	Moderate: slope	Slight.
Modjeska: 168, 169	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
170	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
171	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: small stones.
Myford: 172, 173 174, 175, 176	Severe: percs slowly	Slight	Severe: percs slowly.	Slight.
177	Severe: percs slowly	Moderate: slope	Severe: slope, percs slowly.	Slight.
178, 179	Severe: slope, percs slowly.	Severe: slope	Severe: slope, percs slowly.	Moderate: slope.
Nacimiento: 180	Severe: slope	Severe: slope	Severe: slope	Moderate: slope, too clayey.
181	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Omni: 182	Moderate: percs slowly, dusty.	Moderate: dusty	Moderate: dusty, percs slowly.	Moderate: dusty.
183	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
184	Severe: too clayey	Severe: too clayey	Severe: too clayey.	Severe: too clayey.
Pits: 185.				
Ramona: 186	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
187	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
Rincon: 188	Moderate: percs slowly, too clayey.	Moderate: too clayey	Moderate: percs slowly, too clayey, slope.	Moderate: too clayey.
189	Moderate: percs slowly, too clayey, slope.	Moderate: too clayey, slope.	Severe: slope	Moderate: too clayey.
190	Severe: slope	Severe: slope	Severe: slope	Moderate: too clayey, slope.
Riverwash: 191.				
Rock outcrop: [1] 192: Rock outcrop part.				

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Cieneba part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
San Andreas: 193	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
San Emigdio: 194	Slight	Slight	Slight	Slight.
195	Slight	Slight	Moderate: slope	Slight.
196	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Soboba: 197	Moderate: small stones, too sandy.	Moderate: small stones, too sandy.	Severe: small stones.	Moderate: small stones, too sandy.
198	Moderate: small stones, too sandy.	Moderate: small stones, too sandy.	Severe: slope	Moderate: small stones, too sandy.
Soper: 199, 201	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
200, 202, 203	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] 204: Soper part	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Rock outcrop part.				
Sorrento: 205, 206	Slight	Slight	Slight	Slight.
207	Slight	Slight	Moderate: slope	Slight.
208	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.	Moderate: too clayey.
209	Moderate: too clayey	Moderate: too clayey	Moderate: slope, too clayey.	Moderate: too clayey.
Thapto-Histic Fluvaquents: 210	Moderate: percs slowly, wetness, too clayey.	Moderate: wetness, too clayey.	Moderate: wetness, too clayey.	Moderate: wetness, too clayey.
Tidal flats: 211.				
Tollhouse: [1] 212: Tollhouse part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop part.				
Vista: 213	Moderate: slope	Moderate: slope	Severe: slope	Slight.
214	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
215	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] 216: Vista part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Rock outcrop part.				

TABLE 8.—*Recreational development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Xeralfic Arents: 217	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
218	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Xerorthents: 219	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
220	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Yorba: 221	Moderate: small stones, percs slowly.	Moderate: small stones.	Moderate: small stones, percs slowly.	Moderate: small stones.
222	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
223, 224, 225	Severe: slope	Severe: slope	Severe: slope, small stones.	Moderate: slope, small stones.
226	Severe: slope	Severe: slope	Severe: slope, small stones.	Severe: slope.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a groundwater aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 7 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to pub-

lic sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 5, and interpretations for dwellings without basements and for local roads and streets, given in table 4.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Soil Properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 9 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 9 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Descriptions of the Soils."

Texture is described in table 9 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The USCS system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes: eight classes of

coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL–ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified in group A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 12. The estimated classification, without group index numbers, is given in table 9. Also in table 9 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 10 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field, particularly soil structure, porosity, and gradation or texture that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 10. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible

TABLE 9.—*Engineering properties*

[The symbol < means less than; > means greater than.

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Alo:				
100, 101, 102	0–25	Clay	CH, CL	A–7
	25	Weathered bedrock		
Alo Variant:				
103, 104, 105	0–40	Clay	CH, CL	A–7
	40	Weathered bedrock		
Anaheim:				
106, 107	0–26	Loam	CL–ML, ML	A–4
	26	Weathered bedrock		
108, 109, 110	0–26	Clay loam	CL	A–6
	26	Weathered bedrock		
Balcom:				
111, 112, 113	0–30	Clay loam	CL	A–6, A–7
	30	Weathered bedrock		
[1] 114:				
Balcom part	0–26	Clay loam	CL	A–6, A–7
	26	Weathered bedrock		
Rock outcrop part.				
Beaches:				
115	0–60	Variable		
Blasingame:				
116	0–8	Loam	CL–ML, CL	A–4
	8–26	Clay loam	CL	A–6
	26	Weathered bedrock		
117, 118	0–8	Stony loam	CL–ML, CL	A–4
	8–26	Stony clay loam	CL	A–6
	26	Weathered bedrock		
[1] 119:				
Blasingame part	0–8	Loam	CL–ML, CL	A–4
	8–24	Clay loam	CL	A–6
	24	Weathered bedrock		
Rock outcrop part.				
[1] 120:				
Blasingame part	0–8	Loam	CL–ML, CL	A–4
	8–26	Clay loam	CL	A–6
	26	Weathered bedrock		
Vista part	0–39	Coarse sandy loam	SM	A–2
	39	Weathered bedrock		
[1] 121:				
Blasingame part	0–8	Loam	CL–ML, CL	A–4
	8–26	Clay loam	CL	A–6
	26	Weathered bedrock		
Vista part	0–39	Coarse sandy loam	SM	A–2
	39	Weathered bedrock		
Bolsa:				
122, 123	0–29	Silt loam	CL	A–6
	29–69	Silty clay loam	CL	A–6
124, 125	0–69	Silty clay loam	CL	A–6
Bosanko:				
126, 127, 128	0–37	Clay	CH, CL	A–7
	37	Weathered bedrock		

and classifications

Absence of an entry means data were not estimated]

Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	95–100	85–100	40–60	20–40
0	100	100	95–100	85–100	40–60	20–40
0	100	100	85–95	60–75	20–35	5–10
0	100	100	90–100	70–80	30–40	10–20
0	100	100	90–100	70–85	35–45	15–20
0	100	100	90–100	70–85	35–45	15–20
0–10	100	85–95	75–90	60–75	20–30	5–10
0–10	100	90–100	90–100	70–80	30–40	10–20
10–50	80–90	75–85	60–75	50–65	20–30	5–10
10–50	80–90	75–85	70–80	60–70	30–40	10–20
0–10	100	85–95	75–90	60–75	20–30	5–10
0–10	100	90–100	90–100	70–80	30–40	10–20
0–10	100	85–95	75–90	60–75	20–30	5–10
0–10	100	90–100	90–100	70–80	30–40	10–20
0	90–100	80–95	45–65	20–35		NP
0–10	100	85–95	75–90	60–75	20–30	5–10
0–10	100	90–100	90–100	70–80	30–40	10–20
0	90–100	80–95	45–65	20–35		NP
0	100	100	95–100	80–95	25–35	10–15
0	100	100	95–100	80–95	25–35	10–15
0	100	100	95–100	80–95	25–35	10–15
0	100	100	85–95	65–75	40–60	20–35

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
[1] 129:				
Bosanko part	0–37	Clay	CH, CL	A–7
	37	Weathered bedrock		
Balcom part	0–30	Clay loam	CL	A–6, A–7
	30	Weathered bedrock		
[1] 130:				
Bosanko part	0–37	Clay	CH, CL	A–7
	37	Weathered bedrock		
Balcom part	0–30	Clay loam	CL	A–6, A–7
	30	Weathered bedrock		
Botella:				
131	0–8	Loam	CL–ML, CL	A–4, A–6
	8–35	Silty clay loam	CL	A–6, A–7
	35–66	Clay loam	CL	A–6
132, 133	0–8	Clay loam	CL	A–6, A–7
	8–35	Silty clay loam	CL	A–6, A–7
	35–66	Clay loam	CL	A–6, A–7
Calleguas:				
134	0–15	Clay loam	CL, CL–ML	A–6, A–4
	15	Weathered bedrock		
Capistrano:				
135, 136	0–65	Sandy loam	SM	A–2, A–4
Chesterton:				
137, 138	0–16	Loamy sand	SM, SM–SC	A–2
	16–32	Sandy clay	CL, SC	A–6, A–7
	32	Indurated		
Chino:				
139, 140	0–47	Silty clay loam	CL	A6, A–7
	47–60	Sandy clay loam	SC, CL	A–6
Cieneba:				
141	0–17	Sandy loam	SM, ML	A–4
	17	Weathered bedrock		
142	0–7	Sandy loam	SM, ML	A–4
	7	Weathered bedrock		
[1] 143:				
Cieneba part	0–17	Sandy loam	SM, ML	A–4
	17	Weathered bedrock		
Blasingame part	0–8	Loam	CL–ML, CL	A–4
	8–26	Clay loam	CL	A–6
	26	Weathered bedrock		
Rock outcrop part.				
[1] 144:				
Cieneba part	0–7	Sandy loam	SM, ML	A–4
	7	Weathered bedrock		
Rock outcrop part.				
[1] 145:				
Cieneba part	0–7	Sandy loam	SM, ML	A–4
	7	Weathered bedrock		
Rock outcrop part.				

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—Cont.				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	85–95	65–75	40–60	20–35
0	100	100	90–100	70–85	35–45	15–20
0	100	100	85–95	65–75	40–60	20–35
0	100	100	90–100	70–85	35–45	15–20
0	80–100	75–100	65–95	50–70	25–35	5–15
0	90–100	85–100	70–95	60–80	35–45	15–25
0	90–100	85–100	70–90	50–65	30–40	10–15
0	80–100	75–100	70–95	60–80	35–45	15–25
0	90–100	85–100	70–95	60–80	35–45	15–25
0	90–100	85–100	70–95	60–80	35–45	15–25
0	90–100	80–100	65–100	55–90	20–40	5–20
0	95–100	95–100	55–85	25–50	10–25	NP–4
0	90–100	75–90	50–70	10–25	10–25	NP–5
0	90–100	75–90	60–90	40–70	35–45	15–25
0	100	100	90–100	70–85	30–50	15–25
0	100	100	95–100	35–65	30–40	10–15
0	90–100	75–95	60–80	35–60	15–30	NP–5
0	90–100	75–95	60–80	35–60	15–30	NP–5
0	90–100	75–95	60–80	35–60	15–30	NP–5
0–10	100	85–95	75–90	60–75	20–30	5–10
0–10	100	90–100	90–100	70–80	30–40	10–20
0	90–100	75–95	60–80	35–60	15–30	NP–5
0	90–100	75–95	60–80	35–60	15–30	NP–5

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Corralitos:				
146	0–80	Loamy sand	SM	A–1, A–2
147	0–40	Loamy sand	SM	A–2
	40–46	Silt loam, silty clay loam	ML, CL–ML	A–4, A–5, A–6
	46–80	Sand, fine sand, loamy sand	SM, SP–SM	A–1, A–2, A–3
Cropley:				
148, 149	0–65	Clay	CL, CH	A–7
Escondido:				
150, 151	0–16	Very fine sandy loam	ML, CL–ML	A–4
	16–29	Very fine sandy loam	ML, CL–ML	A–4
	29	Unweathered bedrock		
Exchequer:				
[1] 152:				
Exchequer part	0–18	Gravelly silt loam	SM, SM–SC	A–4
	18	Unweathered bedrock		
Rock outcrop part.				
Friant:				
153	0–17	Gravelly fine sandy loam	SM, SM–SC	A–4
	17	Weathered bedrock		
Gabino:				
154	0–10	Gravelly clay loam	CL, SC	A–6
	10–38	Cobbly clay, gravelly clay	CH, CL	A–7
	38	Weathered bedrock		
Garretson:				
155	0–6	Gravelly very fine sandy loam	SC, CL–ML, CL, SM–SC	A–4, A–2
	6–60	Gravelly loam, gravelly clay loam	SC, CL, CL–ML, SM–SC	A–4, A–6, A–2
Hanford:				
156	0–48	Sandy loam	SM	A–2, A–4
	48–60	Gravelly loamy sand	SM	A–1
Hueneme:				
157	0–27	Fine sandy loam	SM	A–4
	27–60	Stratified silt loam to sand	SM	A–2, A–4
158	0–27	Fine sandy loam	SM	A–4
	27–60	Stratified silt loam to loamy sand	SM	A–2, A–4
Las Posas:				
159	0–9	Gravelly loam	SM–SC, CL–ML	A–2, A–4
	9–27	Clay	CL, CH	A–6, A–7
	27	Weathered bedrock		
Laughlin:				
160	0–23	Gravelly loam	GC, CL	A–6
	23–39	Gravelly clay loam, clay loam	CL, GC	A–6
	39	Weathered bedrock		
Marina:				
161, 162	0–60	Loamy sand	SM, SP–SM	A–2
	60–80	Sand	SP–SM, SM	A–2
Metz:				
163	0–20	Loamy sand	SM	A–2
	20–63	Stratified sand to very fine sandy loam	SM	A–2
164	0–20	Loamy sand	SM	A–2
	20–40	Stratified sand to very fine sandy loam	SM	A–2
	40–56	Silty clay loam	CL	A–6
	56–63	Stratified sand to silty clay loam	SM, SC, ML, CL	A–4, A–6

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—Cont.				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	95–100	80–100	45–90	15–35	5–30	NP–5
0	95–100	75–100	50–80	15–35	5–30	NP–5
0	95–100	75–100	70–100	65–95	25–45	5–15
0	95–100	75–100	40–80	5–35		NP
0	100	95–100	80–100	70–95	40–60	15–30
0	100	100	80–95	50–65	15–35	5–10
0	100	100	80–95	50–65	15–35	5–10
0–10	70–85	55–75	50–70	35–50	20–35	5–10
0–10	70–90	60–85	50–70	35–45	20–30	NP–10
5–15	75–85	60–75	55–85	40–65	30–40	10–20
5–35	80–95	70–85	65–85	50–80	40–60	25–35
0	75–100	50–75	40–70	25–60	15–30	5–10
0–10	75–100	50–75	40–75	20–65	15–40	5–20
0	85–100	80–100	50–80	20–40	15–25	NP–5
0	65–85	55–75	30–50	10–20		NP
0	100	95–100	65–80	35–50	15–30	NP–5
0	100	95–100	60–70	30–50	15–30	NP–5
0	100	95–100	65–80	35–50	15–30	NP–5
0	100	95–100	60–70	30–50	15–30	NP–5
0–5	80–95	65–75	50–70	30–60	20–30	5–10
0	100	100	90–100	75–95	35–55	15–35
0–5	55–95	50–75	50–65	35–55	15–30	10–15
0–5	55–90	50–90	50–85	45–80	20–40	10–20
0	100	100	50–75	5–30	<5	NP
0	100	100	50–75	5–15		NP
0	100	100	50–70	15–35		NP
0	100	100	60–80	15–35		NP
0	100	100	50–70	15–35		NP
0	100	100	60–80	15–35		NP
0	100	100	90–100	85–95	30–40	15–25
0	100	100	60–80	40–60	<40	NP–20

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Mocho:				
165	0–12	Sandy loam	SM	A–2, A–4
	12–61	Loam, silty clay loam, fine sandy loam	CL, CL–ML	A–4, A–6
166, 167	0–31	Loam	CL–ML, CL	A–4, A–6
	31–61	Loam, silty clay loam, fine sandy loam	CL, CL–ML	A–4, A–6
Modjeska:				
168, 169, 170, 171	0–14	Gravelly loam	SC, SM–SC	A–2, A–4
	14–63	Very cobbly loam	SM	A–1
	63–71	Very gravelly loamy sand	SM, SP–SM	A–1
Myford:				
172, 173, 174, 175, 176, 177, 178, 179	0–12	Sandy loam	SM, SM–SC, ML, CL–ML	A–2, A–4
	12–49	Sandy clay, sandy clay loam	SC, CL	A–6, A–7
	49–79	Sandy loam	SM, SM–SC, ML, CL–ML	A–2, A–4
Nacimiento:				
180, 181	0–28	Clay loam	CL	A6, A–7
	28	Weathered bedrock		
Omni:				
182	0–12	Silt loam	CL–ML, CL	A–4, A–6
	12–60	Clay	CL, CH	A–7
183	0–17	Clay	CL, CH	A–7
	17–60	Clay	CL, CH	A–7
184	0–17	Clay	CL, CH	A–7
	17–60	Clay	CL, CH	A–7
Pits:				
185.				
Ramona:				
186	0–8	Fine sandy loam	SM	A–2, A–4, A–1
	8–69	Sandy clay loam, fine sandy loam	SC, SM–SC	A–2, A–4, A–6, A–1
187	0–8	Gravelly fine sandy loam	SM	A–1, A–2, A–1
	8–69	Sandy clay loam, fine sandy loam	SC, SM–SC	A–2, A–4, A–6, A–1
Rincon:				
188, 189 190	0–11	Clay loam	CL	A–6, A–7
	11–28	Heavy clay loam	CL, CH	A–6, A–7
	28–60	Stratified clay	SC, CL	A–6
Riverwash:				
191.				
Rock outcrop:				
[1] 192:				
Rock outcrop part.				
Cieneba part	0–7	Sandy loam	SM, ML	A–4
	7	Weathered bedrock		
San Andreas:				
193	0–31	Sandy loam	SM	A–4, A–2
	31	Weathered bedrock		
San Emigdio:				
194, 195	0–7	Fine sandy loam	SC, SM, ML, CL	A–4
	7–61	Stratified very fine sandy loam to gravelly loamy coarse sand.	SC, SM, ML, CL	A–4, A–2

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—Cont.				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	80–100	75–100	50–70	25–40	10–20	NP–5
0	80–100	75–100	70–100	65–85	25–40	5–20
0	80–100	75–100	70–95	60–75	20–40	5–15
0	80–100	75–100	70–100	65–85	25–40	5–20
5–15	75–90	50–70	45–65	35–50	15–25	5–10
30–60	80–95	15–25	15–25	10–20	10–15	NP–5
5–15	80–95	15–25	10–20	5–15		NP
0	100	100	60–85	30–55	20–30	NP–10
0	100	100	80–100	40–80	25–45	10–25
0	100	100	60–85	30–55	15–30	NP–10
0	80–100	75–100	70–95	65–85	30–45	10–30
0	100	100	90–100	70–90	20–35	5–15
0	100	100	90–100	75–95	45–70	20–45
0	100	95–100	90–100	80–95	45–70	20–50
0	90–100	90–100	80–100	70–95	45–70	20–45
0	100	100	90–100	75–95	45–70	20–50
0	100	100	90–100	75–95	45–70	20–45
0	95–100	75–95	40–70	20–50	15–30	NP–5
0	95–100	50–95	30–75	15–45	20–40	5–15
0	95–100	50–75	30–50	15–35	15–30	NP–5
0	95–100	50–95	30–75	15–45	20–40	5–15
0	100	95–100	90–100	80–100	30–50	10–30
0	90–100	85–100	80–100	35–70	20–40	15–35
0	90–100	85–100	80–100	35–70	20–40	10–25
0	90–100	75–95	60–80	35–60	15–30	NP–5
0	90–100	80–100	70–95	30–40	10–40	NP–10
0	95–100	90–100	75–90	35–60	15–30	NP–10
0	80–100	70–100	60–90	35–60	15–30	NP–10

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
196	0–7	Fine sandy loam	ML	A–4
	7–40	Stratified very fine sandy loam to gravelly loamy coarse sand	SM, ML, SC, CL	A–2, A–4
	40–43	Silt loam, silty clay loam	CL	A–6, A–7
	43–61	Stratified very fine sandy loam to gravelly loamy coarse sand.	SM, ML, SC, CL	A–2, A–4
Soboba:				
197	0–10	Cobbly loamy sand	GP–GM, SP–SM	A–1
	10–60	Very gravelly sand	GP, SP	A–1
198	0–10	Gravelly loamy sand	GP–GM, SP–SM	A–1
	10–60	Very gravelly sand	GP, SP	A–1
Soper:				
199, 200	0–8	Loam	ML, CL–ML, SM, SM–SC	A–4
	8–29	Clay loam, loam	CL, SC	A–6, A–7
	29	Weathered bedrock		
201, 202	0–8	Gravelly loam	ML, CL–ML, SM, SM–SC	A–4
	8–29	Gravelly clay loam, gravelly loam	CL, SC	A–6, A–7
	29	Weathered bedrock		
203	0–8	Cobbly loam	ML, CL–ML, SM, SM–SC	A–4
	8–29	Gravelly clay loam, gravelly loam	CL, SC	A–6, A–7
	29	Weathered bedrock		
[1] 204:				
Soper part	0–4	Gravelly loam	ML, CL–ML, SM, SM–SC	A–4
	4–20	Gravelly clay loam, gravelly loam	CL, SC	A–6, A–7
	20	Weathered bedrock		
Rock outcrop part.				
Sorrento:				
205	0–12	Sandy loam	SM	A–4
	12–62	Silty clay loam	CL	A–6, A–7
	62–72	Sandy loam	SM	A–4, A–2
206, 207	0–12	Loam	ML, CL–ML	A–4
	12–62	Silty clay loam	CL	A–6, A–7
	62–72	Sandy loam	SM	A–4, A–2
208, 209	0–12	Clay loam	CL	A–6, A–7
	12–62	Silty clay loam	CL	A–6, A–7
	62–72	Loam, sandy loam	SM	A–4, A–2
Thapto-Histic Fluvaquents:				
210	0–9	Clay loam	OH	A–7
	9–21	Silty clay	CL, CH	A–7
	21–56	Sapric material	Pt	A–8
	56–68	Silty clay loam	ML, MH	A–7
Tidal flats:				
211	0–60	Variable		
Tollhouse:				
[1] 212:				
Tollhouse part	0–8	Coarse sandy loam	SM	A–1, A–2
	8	Weathered bedrock		
Rock outcrop part.				
Vista:				
213, 214, 215	0–39	Coarse sandy loam	SM	A–2, A–1
	39	Weathered bedrock		

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—Cont.				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	80–90	50–65	20–30	NP–10
0	80–100	70–90	60–90	35–60	15–30	NP–10
0	100	100	90–100	85–95	30–50	15–25
0	80–100	70–90	55–80	15–50	10–25	NP–10
10–30	40–60	30–40	20–30	5–10		NP
0–5	40–60	30–40	15–25	0–5		NP
0–5	40–60	30–40	20–30	5–10		NP
0–5	40–60	30–40	15–25	0–5		NP
0–5	90–100	85–95	65–85	40–65	10–35	NP–10
0–15	85–95	85–95	65–85	40–55	30–50	20–35
0–25	80–100	60–75	50–65	45–60	10–35	NP–10
0–15	70–95	50–70	45–60	40–55	30–50	20–35
10–25	80–100	60–75	50–65	45–60	10–35	NP–10
0–15	70–95	50–70	45–60	40–55	30–50	20–35
0–25	80–100	60–75	50–65	45–60	10–35	NP–10
0–15	70–95	50–70	45–60	40–55	30–50	20–35
0	100	95–100	60–70	35–50	10–25	NP–5
0	100	95–100	80–95	70–85	25–45	10–25
0	100	95–100	60–70	30–40	10–25	NP–5
0	100	95–100	75–95	60–80	20–40	5–10
0	100	95–100	80–95	70–85	25–45	10–25
0	100	95–100	60–70	30–40	10–25	NP–5
0	100	95–100	95–100	75–85	30–50	10–25
0	100	95–100	80–95	70–85	25–45	10–25
0	100	95–100	60–70	30–40	10–25	NP–5
0	100	100	95–100	80–95	90–110	20–35
0	100	100	95–100	90–100	40–60	30–40
0	100	100	95–100	90–100	40–60	10–25
0	75–100	55–95	30–85	15–35	<30	NP–5
0	90–100	80–95	45–65	20–35		NP

TABLE 9.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
[1] 216:				
Vista part	0–39	Coarse sandy loam	SM	A–2, A–1
	39	Weathered bedrock		
Rock outcrop part.				
Xeralfic Arents:				
217, 218	0–60	Variable		
Xerorthents:				
219, 220	0–60	Variable		
Yorba:				
221, 222, 223	0–11	Gravelly sandy loam	SM, SM–SC	A–2, A–4, A–1
	11–40	Very gravelly sandy clay loam	GC	A–2, A–6
	40–63	Very gravelly sandy loam	GM, GP–GM	A–1
224, 225	0–11	Cobbly sandy loam	SM, ML, SM–SC, CL–ML	A–2, A–4
	11–40	Very gravelly sandy clay loam	GC	A–2, A–6
	40–63	Very gravelly sandy loam	GM, GP–GM	A1
226	0–11	Cobbly sandy loam	SM, SM–SC	A–2, A–4, A–1
	11–40	Very gravelly sandy clay loam	GC	A–2, A–6
	40–63	Very gravelly sandy loam	GM, GP–GM	A–1

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water (*15*). Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 11 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that

and classifications—Continued

Fragments >3 inches	Percentage passing sieve number—Cont.				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	90–100	80–95	45–65	20–35		NP
0–10	75–90	60–70	40–65	20–50	10–30	NP–10
0–60	35–55	25–50	20–50	10–40	25–40	10–20
0–20	30–50	20–50	10–35	5–20	<20	NP–5
25–35	85–100	75–95	50–85	25–65	10–30	NP–10
0–60	35–55	25–50	20–50	10–40	25–40	10–20
0–20	30–50	20–50	10–35	5–20	<20	NP–5
25–60	75–90	60–70	40–65	20–50	10–30	NP–10
0–60	35–55	25–50	20–50	10–40	25–40	10–20
0–20	30–50	20–50	10–35	5–20	<20	NP–5

behavior of the whole mapping unit.

form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 11 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Engineering test data

Table 12 contains engineering test data for some of the major soils in Orange County and the Western Part of Riverside County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analysis and by tests to determine liquid limits and plastic limits. The mechanical analysis was made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum*

TABLE 10.—*Physical and chemical*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Alo:				
100, 101, 102	0–25	0.06–0.2	0.14–0.17	6.1–8.4
	25			
Alo Variant:				
103, 104, 105	0–40	0.06–0.2	0.14–0.17	6.1–8.4
	40			
Anaheim:				
106, 107	0–26	0.6–2.0	0.15–0.17	6.1–7.8
	26			
108, 109, 110	0–26	0.2–0.6	0.17–0.19	6.1–7.8
	26			
Balcom:				
111, 112, 113	0–30	0.2–0.6	0.15–0.17	7.9–8.4
	30			
[1] 114:				
Balcom part	0–26	0.2–0.6	0.15–0.17	7.9–8.4
	26			
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	0–8	0.6–2.0	0.13–0.17	6.1–7.3
	8–26	0.2–0.6	0.17–0.19	5.6–6.0
	26			
117, 118	0–8	0.6–2.0	0.11–0.13	6.1–7.3
	8–26	0.2–0.6	0.13–0.15	5.6–6.0
	26			
[1] 119:				
Blasingame part	0–8	0.6–2.0	0.13–0.17	6.1–7.3
	8–24	0.2–0.6	0.17–0.19	5.6–6.0
	24			
Rock outcrop part.				
[1] 120:				
Blasingame part	0–8	0.6–2.0	0.11–0.13	6.1–7.3
	8–26	0.2–0.6	0.13–0.15	5.6–6.0
	26			
Vista part	0–39	2.0–6.0	0.07–0.13	6.1–7.3
	39			
[1] 121:				
Blasingame part	0–8	0.6–2.0	0.11–0.13	6.1–7.3
	8–26	0.2–0.6	0.13–0.15	5.6–6.0
	26			
Vista part	0–39	2.0–6.0	0.07–0.13	6.1–7.3
	39			
Bolsa:				
122, 123	0–29	0.2–0.6	0.19–0.21	7.9–8.4
	29–69	0.2–0.6	0.19–0.21	7.9–8.4
124, 125	0–69	0.2–0.6	0.19–0.21	7.9–8.4

properties of soils

erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	High	High	Low	0.24	2
<2	High	High	Low	0.24	2
<2	Low	Low	Low	0.37	2
<2	Moderate	Moderate	Low	0.32	2
<2	Moderate	Moderate	Low	0.37	2
<2	Moderate	Moderate	Low	0.37	2
<2 <2	Low Moderate	Low Moderate	Low Moderate	0.43 0.20	2
<2 <2	Low Low	Low Moderate	Low Moderate	0.37 0.17	2
<2 <2	Low Moderate	Low Moderate	Low Moderate	0.43 0.20	2
<2 <2	Low Moderate	Low Moderate	Low Moderate	0.37 0.17	2
<2	Low	Moderate	Moderate	0.28	2
<2 <2	Low Moderate	Low Moderate	Low Moderate	0.37 0.17	2
<2	Low	Moderate	Moderate	0.28	2
<2 <2	Moderate Moderate	High High	Low Low	0.43 0.43	5
<2	Moderate	High	Low	0.43	5

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Bosanko:				
126, 127, 128	0–37 37	0.06–0.2	0.14–0.17	6.1–8.4
[1] 129:				
Bosanko part	0–37 37	0.06–0.2	0.14–0.17	6.1–8.4
Balcom part	0–30 30	0.2–0.6	0.15–0.17	7.9–8.4
[1] 130:				
Bosanko part	0–37 37	0.06–0.2	0.14–0.17	6.1–8.4
Balcom part	0–30 30	0.2–0.6	0.15–0.17	7.9–8.4
Botella:				
131	0–8 8–35 35–66	0.6–2.0 0.2–0.6 0.2–0.6	0.15–0.18 0.16–0.19 0.15–0.19	6.1–7.3 6.1–7.8 7.4–8.4
132, 133	0–8 8–35 35–66	0.2–0.6 0.2–0.6 0.2–0.6	0.15–0.18 0.16–0.19 0.15–0.19	6.1–7.3 6.1–7.8 7.4–8.4
Calleguas:				
134	0–15 15	0.6–2.0	0.15–0.18	7.9–8.4
Capistrano:				
135, 136	0–65	2.0–6.0	0.09–0.13	5.6–7.3
Chesterton:				
137, 138	0–16 16–32 32	2.0–6.0 <0.06	0.09–0.13 0.06–0.08	5.1–6.0 5.1–6.0
Chino:				
139	0–47 47–60	0.2–0.6 0.2–0.6	0.16–0.22 0.16–0.22	7.9–8.4 7.9–8.4
140	0–47 47–60	0.2–0.6 0.2–0.6	0.16–0.22 0.16–0.22	7.9–8.4 7.9–8.4
Cieneba:				
141	0–17 17	2.0–6.0	0.13–0.16	5.6–7.3
142	0–7 7	2.0–6.0	0.13–0.16	5.6–7.3
[1] 143:				
Cieneba part	0–17 17	2.0–6.0	0.13–0.16	5.6–7.3
Blasingame part	0–8 8–26 26	0.6–2.0 0.2–0.6	0.13–0.17 0.17–0.19	6.1–7.3 5.6–6.0
Rock outcrop part.				
[1] 144:				
Cieneba part	0–17 17	2.0–6.0	0.13–0.16	5.6–7.3
Rock outcrop part.				

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	High	High	Low	0.28	3
<2	High	High	Low	0.28	3
<2	Moderate	Moderate	Low	0.37	2
<2	High	High	Low	0.28	3
<2	Moderate	Moderate	Low	0.37	2
<2	Moderate	Moderate	Low	0.43	5
<2	Moderate	Moderate	Low	0.32	
<2	Moderate	Moderate	Low	0.32	
<2	Moderate	Moderate	Low	0.37	5
<2	Moderate	Moderate	Low	0.32	
<2	Moderate	Moderate	Low	0.32	
<2	Moderate	High	Low	0.32	1
<2	Low	Low	Low	0.24	5
<2	Low	Low	Low	0.32	2
<2	Moderate	High	Low	0.32	
>2	Moderate	High	Low		
>2	Moderate	High	Low		
<2	Moderate	Moderate	Low		
<2	Moderate	High	Low		
<2	Low	Low	Low	0.24	1
<2	Low	Low	Low	0.24	1
<2	Low	Low	Low	0.24	1
<2	Low	Low	Low	0.43	2
<2	Moderate	Moderate	Moderate	0.20	
<2	Low	Low	Low	0.24	1

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
[1] 45:				
Cieneba part	0–7	2.0–6.0	0.13–0.16	5.6–7.3
	7			
Rock outcrop part.				
Corralitos:				
146	0–80	6.0–20	0.07–0.09	5.6–7.3
147	0–40	6.0–20	0.07–0.09	5.6–7.3
	40–46	0.06–0.2	0.19–0.21	5.6–7.3
	46–80	6.0–20	0.07–0.09	5.6–7.3
Cropley:				
148, 149	0–65	0.06–0.2	0.13–0.17	6.6–8.4
Escondido:				
150, 151	0–16	0.6–2.0	0.14–0.16	5.6–6.5
	16–29	0.6–2.0	0.13–0.16	5.6–7.3
	29			
Exchequer:				
[1] 152:				
Exchequer part	0–18	0.6–2.0	0.11–0.16	5.1–6.5
	18			
Rock outcrop part.				
Friant:				
153	0–17	2.0–6.0	0.10–0.12	5.6–7.3
	17			
Gabino:				
154	0–10	0.2–0.6	0.12–0.17	5.6–6.5
	10–38	0.06–0.2	0.10–0.15	6.1–7.8
	38			
Garretson:				
155	0–6	0.6–2.0	0.10–0.15	6.1–7.3
	6–60	0.6–2.0	0.10–0.15	6.1–7.8
Hanford:				
156	0–48	2.0–6.0	0.12–0.15	6.1–7.3
	48–60	2.0–6.0	0.12–0.15	6.1–7.3
Hueneme:				
157	0–27	2.0–6.0	0.14–0.16	7.4–8.4
	27–60	2.0–6.0	0.14–0.16	7.4–8.4
158	0–27	2.0–6.0	0.14–0.16	7.4–8.4
	27–60	2.0–6.0	0.14–0.16	7.4–8.4
Las Posas:				
159	0–9	0.6–2.0	0.11–0.13	6.1–7.3
	9–27	0.2–0.6	0.14–0.17	6.1–7.8
	27			
Laughlin:				
160	0–23	2.0–6.0	0.13–0.15	5.6–6.5
	23–39	0.6–2.0	0.13–0.15	5.6–6.5
	39			
Marina:				
161, 162	0–60	0.6–2.0	0.06–0.08	5.6–7.3
	60–80	0.6–2.0	0.05–0.07	5.6–6.5

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	Low	Low	Low	0.24	1
<2	Low	Moderate	Moderate	0.28	5
<2	Low	Moderate	Moderate	0.17	5
<2	Moderate	High	Moderate	0.24	
<2	Low	Moderate	Moderate	0.17	
<2	High	High	Low	0.24	5
<2	Low	Moderate	Moderate	0.43	2
<2	Low	Moderate	Moderate	0.49	
<2	Low	Low	Moderate	0.37	1
<2	Low	Low	Low	0.32	1
<2	Moderate	Moderate	Moderate	0.32	3
<2	High	High	Low	0.24	
<2	Low	Low	Low	0.32	5
<2	Low	Low	Low	0.32	
<2	Low	Moderate	Low	0.24	5
<2	Low	Moderate	Low	0.24	
2–4	Low	High	Low		
2–4	Low	High	Low		
2–4	Low	High	Low		
2–4	Low	High	Low		
<2	Low	Moderate	Low	0.24	2
<2	High	High	Low	0.24	
<2	Low	Moderate	Moderate	0.24	2
<2	Moderate	Moderate	Moderate	0.32	
<2	Low	Low	Low	0.10	5
<2	Low	Low	Low	0.10	

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Metz:				
163	0–20	6.0–20	0.07–0.11	6.6–8.4
	20–63	0.6–2.0	0.07–0.10	6.6–8.4
164	0–20	6.0–20	0.07–0.11	6.6–8.4
	20–40	0.6–2.0	0.07–0.10	6.6–8.4
	40–56	0.6–2.0	0.16–0.18	6.6–8.4
	56–63	0.2–2.0	0.07–0.18	6.6–8.4
Mocho:				
165	0–12	0.6–2.0	0.16–0.20	7.9–8.4
	12–61	0.6–2.0	0.16–0.21	7.9–8.4
166, 167	0–31	0.6–2.0	0.16–0.20	7.9–8.4
	31–61	0.6–2.0	0.16–0.21	7.9–8.4
Modjeska:				
168, 169, 170 171	0–14	2.0–6.0	0.10–0.12	6.1–6.5
	14–63	2.0–6.0	0.07–0.10	6.1–6.5
	63–71	>20	0.05–0.07	6.1–6.5
Myford:				
172, 173, 174 175, 176 177 178, 179	0–12	2.0–6.0	0.10–0.14	5.1–6.0
	12–49	<0.06	0.02–0.04	5.6–8.4
	49–79	0.6–2.0	0.02–0.04	6.1–6.5
Nacimiento:				
180 181	0–28	0.2–0.6	0.17–0.19	7.4–8.4
	28			
Omni:				
182	0–12	0.6–2.0	0.14–0.20	7.9–9.0
	12–60	0.06–0.6	0.14–0.20	7.9–9.0
183	0–17	0.06–0.2	0.14–0.20	8.5–9.0
	17–60	0.06–0.6	0.14–0.20	7.9–9.0
184	0–17	0.06–0.2	0.14–0.20	7.9–9.0
	17–60	0.06–0.6	0.14–0.20	7.9–9.0
Pits:				
185.				
Ramona:				
186	0–8	2.0–6.0	0.09–0.11	6.1–7.3
	8–69	0.2–0.6	0.13–0.18	6.1–7.8
187	0–8	2.0–6.0	0.05–0.09	6.1–7.3
	8–69	0.2–0.6	0.13–0.18	6.1–7.8
Rincon:				
188, 189, 190	0–11	0.2–0.6	0.17–0.21	6.1–8.4
	11–28	0.06–0.2	0.15–0.18	6.6–8.4
	28–60	0.2–6.0	0.13–0.17	7.4–8.4
Riverwash:				
191.				
Rock outcrop:				
[1] 192:				
Rock outcrop part.				
Cieneba part	0–7	2.0–6.0	0.13–0.16	5.6–7.3
	7			
San Andreas:				
193	0–31	2.0–6.0	0.11–0.17	5.6–6.5
	31			

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	Low	High	Low	0.17	5
<2	Low	High	Low	0.15	
<2	Low	High	Low	0.17	5
<2	Low	High	Low	0.15	
<2	Moderate	High	Low	0.49	
<2	Low	High	Low	0.28	
<2	Low	High	Low	0.24	5
<2	Moderate	High	Low	0.43	
<2	Low	High	Low	0.43	5
<2	Moderate	High	Low	0.43	
<2	Low	Low	Moderate	0.20	2
<2	Low	Low	Moderate	0.17	
<2	Low	Low	Moderate	0.15	
<2	Low	High	Moderate	0.32	2
<2	High	High	Moderate	0.24	
<2	Low	High	Low	0.28	
<2	Moderate	High	Low	0.32	2
<2	Moderate	High	Moderate		
<2	High	High	Moderate		
<2	Very high	High	Moderate	0.37	5
<2	Very high	High	Moderate	0.37	
<2	High	High	Moderate		
<2	High	High	Moderate		
<2	Low	Low	Moderate	0.37	5
<2	Low	Moderate	Low	0.32	
<2	Low	Low	Moderate	0.32	5
<2	Low	Moderate	Low	0.32	
<2	Moderate	Moderate	Moderate	0.37	4
<2	High	High	Low	0.43	
<2	Moderate	High	Low	0.37	
<2	Low	Low	Low	0.24	1
<2	Low	Moderate	Moderate	0.15	2

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
San Emigdio:				
194, 195	0–7	2.0–6.0	0.12–0.17	7.9–8.4
	7–61	2.0–6.0	0.12–0.17	7.9–8.4
196	0–7	2.0–6.0	0.12–0.17	7.9–8.4
	7–40	2.0–6.0	0.11–0.16	7.9–8.4
	40–43	0.2–0.6	0.14–0.19	7.9–8.4
	43–61	2.0–6.0	0.11–0.16	7.9–8.4
Soboba:				
197	0–10	>20	0.02–0.04	6.1–7.8
	10–60	>20	0.02–0.04	6.1–7.8
198	0–10	>20	0.02–0.04	6.1–7.8
	10–60	>20	0.02–0.04	6.1–7.8
Soper:				
199, 200	0–8	0.6–2.0	0.15–0.20	6.1–7.3
	8–29	0.2–0.6	0.12–0.14	6.1–7.8
	29			
201, 202, 203	0–8	0.6–2.0	0.13–0.18	6.1–7.3
	8–29	0.2–0.6	0.12–0.14	6.1–7.8
	29			
[1]204:				
Soper part	0–4	0.6–2.0	0.13–0.18	6.1–7.3
	4–20	0.2–0.6	0.12–0.14	6.1–7.8
	20			
Rock outcrop part.				
Sorrento:				
205	0–12	2.0–6.0	0.15–0.18	6.1–8.4
	12–62	0.2–2.0	0.16–0.21	7.9–8.4
	62–72	0.6–2.0	0.16–0.21	7.9–8.4
206, 207	0–12	0.6–2.0	0.16–0.21	6.1–8.4
	12–62	0.2–2.0	0.16–0.21	7.9–8.4
	62–72	0.6–2.0	0.16–0.21	7.9–8.4
208, 209	0–12	0.2–0.6	0.18–0.21	6.1–8.4
	12–62	0.2–2.0	0.16–0.21	7.9–8.4
	62–72	0.6–2.0	0.16–0.21	7.9–8.4
Thapto-Histic Fluvaquents:				
210	0–9	0.06–0.2	0.15–0.18	7.9–8.4
	9–21	0.06–0.2	0.20–0.24	5.1–6.0
	21–56	2.0–6.0	0.20–0.24	5.1–6.0
	56–68	0.06–0.2	0.15–0.18	6.1–6.5
Tidal flats:				
211.				
Tollhouse:				
[1]212:				
Tollhouse part	0–8	6.0–20	0.06–0.10	5.6–6.5
	8			
Rock outcrop part.				
Vista:				
213, 214, 215	0–39	2.0–6.0	0.07–0.13	6.1–7.3
	39			

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	Low	High	Low	0.32	5
<2	Low	High	Low	0.32	
<2	Low	High	Low	0.32	5
<2	Low	High	Low	0.24	
<2	Low	High	Low	0.49	
<2	Low	High	Low	0.24	
<2	Low	Low	Low	0.15	5
<2	Low	Low	Low		
<2	Low	Low	Low	0.15	5
<2	Low	Low	Low	0.15	
<2	Low	Moderate	Moderate	0.32	3
<2	Moderate	Moderate	Low	0.28	
<2	Low	Moderate	Moderate	0.32	3
<2	Moderate	Moderate	Low	0.28	
<2	Low	Moderate	Moderate	0.32	3
<2	Moderate	Moderate	Low	0.28	
<2	Low	High	Low	0.28	5
<2	Moderate	High	Low	0.37	
<2	Low	High	Low	0.37	
<2	Low	High	Low	0.37	5
<2	Moderate	High	Low	0.37	
<2	Low	High	Low	0.37	
<2	Moderate	High	Low	0.32	5
<2	Moderate	High	Low	0.37	
<2	Low	High	Low	0.37	
2–4	High	High	Low		
4–8	High	High	High		
4–8	Low	High	High		
4–8	High	High	High		
<2	Low	Low	Moderate	0.24	1
<2	Low	Moderate	Moderate	0.28	2

TABLE 10.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
[1]216:				
Vista part	0–39	2.0–6.0	0.07–0.13	6.1–7.3
	39			
Rock outcrop part.				
Xeralfic Arents:				
217, 218	0–60			
Xerorthents:				
219, 220	0–60			
Yorba:				
221, 222, 223	0–11	0.6–6.0	0.07–0.10	5.6–6.5
	11–40	0.06–0.2	0.09–0.11	5.6–8.4
	40–63	0.6–2.0	0.03–0.05	5.1–8.4
224, 225	0–11	0.6–6.0	0.07–0.10	5.6–6.5
	11–40	0.06–0.2	0.09–0.11	5.6–8.4
	40–63	0.6–2.0	0.03–0.05	5.1–8.4
226	0–11	0.6–6.0	0.07–0.10	5.6–6.5
	11–40	0.06–0.2	0.09–0.11	5.6–6.5
	40–63	0.6–2.0	0.03–0.05	5.1–8.4

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

moisture content is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained earlier.

Formation and Classification of the Soils

This section describes the major factors of soil formation and tells how these factors have affected the soils of Orange County and Western Part of Riverside County. It also classifies the soils by higher categories.

Factors of Soil Formation

Soil has been defined as a natural body on the surface of the earth in which plants grow. It is organic and mineral material. Soils differ in appearance, composition, management requirements, and productivity in different localities or even within short distances in the survey area. The factors that cause soils to differ are (1) physical and mineralogical composition of the parent material, (2) relief or slope of the land, (3) climate under which the soil material has accumulated, (4) biological activity, including plant and animal life in and on the soil, and (5) length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another. In the following paragraphs, each factor of soil formation is discussed as it affected the formation and development of soils in the survey area.

Parent material

Parent material is the weathered rock or unconsolidated material from which soil forms. It determines the chemical and mineralogical composition of the soil to a great extent.

Sandstone, shale, and semiconsolidated materials occupy the major part of the foothills (*5*). Considerable bedding occurs, and the material varies in hardness and in lime content. In sandstone and shale the percentage of the slowly weatherable mineral quartz is relatively high. These rocks differ mainly in size of the individual grains and strength of the cementing agents. Sandstone is coarser grained. Sandy soils, such as San Andreas and Cieneba, formed in material weathered from sandstone. Loamy and clayey soils, such as Alo, Anaheim, Balcom, Bosanko, Calleguas, and Nacimiento, formed in material weathered from shale.

Metasedimentary, igneous, and metamorphic rocks occupy most of the Santa Ana Mountains uplands. The soils that developed in materials weathered from these rock are shallow or very shallow, are steep or very steep, and have rock outcrops. Examples are Friant, Cieneba, Exchequer, and Tollhouse soils. All lack development because of active erosion. The more gently

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
		Uncoated steel	Concrete	K	T
Mmhos/cm					
<2	Low	Moderate	Moderate	0.28	2
<2	Low	Low	Moderate	0.32	1
<2	Moderate	Moderate	Moderate	0.20	
<2	Low	Low	Moderate	0.24	
<2	Low	Low	Moderate	0.32	1
<2	Moderate	Moderate	Moderate	0.20	
<2	Low	Low	Moderate	0.24	
<2	Low	Low	Moderate	0.32	1
<2	Moderate	Moderate	Moderate	0.20	
<2	Low	Low	Moderate	0.24	

behavior of the whole mapping unit.

sloping soils in this area are moderately deep. Rock crops out in only a few places. These soils, which are generally only slightly or moderately developed, are the Blasingame, Escondido, Las Posas, Laughlin, and Vista.

The soils that formed in alluvium are weakly to strongly developed. Those on flood plains, on recent alluvial fans, and in basins are weakly developed because of recent deposits of alluvium. Examples are Bolsa, Chino, Hueneme, Metz, Mocho, Omni, and San Emigdio soils, all of which are calcareous throughout. These soils are from mixed, but dominantly sedimentary, sources. Other recent alluvial soils are the Capistrano, Corralitos, and Hanford. They are from sedimentary, mixed or granitic sources, and are noncalcareous throughout. The soils formed in the alluvium of terraces are strongly developed. Examples are Myford and Yorba soils.

Relief

Relief, or the shape of the landscape, influences soil formation, mainly through its effects on erosion, drainage or movement of water, and climate. Elevation, slope and exposure to the sun, wind, and air, and drainage affect climate.

Soils on north-facing slopes receive less direct sunlight, have cooler soil temperatures, and retain moisture longer than those on south-facing slopes. They therefore have a dark colored surface layer and are deeper, have less active erosion, and tend to develop a denser vegetative cover than soils on south-facing slopes. For example, Balcom soils, many of which are on north-facing slopes, have a deeper, darker surface layer than Calleguas soils, which commonly are on adjacent south-facing slopes.

On steep and very steep slopes, relief is a major factor in soil formation. In these areas the soil material is removed by erosion almost as fast as it forms. Thus, a deep soil profile seldom develops. Examples of shallow, steep to very steep soils are Cieneba, Friant, and Tollhouse.

Climate

The effect of climate on different soils varies as a result of the complex interaction among the soil-forming factors. Some properties, however, are common to many soils because of the similarity in climate.

The survey area has mildly warm, dry summers and moderately cool, rainy winters. The average air temperature at Santa Ana is 52.5° F in January and 71° in July. The average annual rainfall for most of the area is 14 inches but ranges from 10 to 30 inches. Almost all falls during November through April.

During the rainy period the soils become saturated, and they lose moisture through runoff or deep percolation. They never freeze. In most years, soil moisture in the upper 20 inches falls below the wilting point late in May or in June. The soils become dry unless irrigated.

Evaporation measurements at the Irvine railroad station (1946–51) averaged 59.75 inches per year. The highest monthly evaporation, 7.93 inches, occurs during July, and the lowest monthly evaporation, 2.55 inches, during January. January is the only month in

TABLE 11.—*Soil and*

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Alo:				
100, 101, 102	D	None		
Alo Variant:				
103, 104, 105	D	None		
Anaheim:				
106, 107, 108, 109, 110	C	None		
Balcom:				
111, 112, 113	B	None		
[1] 114:				
Balcom part	B	None		
Rock outcrop part.				
Beaches:				
115.				
Blasingame:				
116	C	None		
117, 118	C	None		
[1] 119:				
Blasingame part	C	None		
Rock outcrop part.				
[1] 120:				
Blasingame part	C	None		
Vista part	C	None		
[1] 121:				
Blasingame part	C	None		
Vista part	C	None		
Bolsa:				
122, 123, 124, 125	C	Rare		
Bosanko:				
126, 127, 128	D	None		
[1] 129:				
Bosanko part	D	None		
[1] 129:				
Balcom part	B	None		
[1] 130:				
Bosanko part	D	None		
Balcom part	B	None		
Botella:				
131, 132, 133	B	None		
Calleguas:				
134	D	None		
Capistrano:				
135, 136	B	None		
Chesterton:				
137, 138	D	None		
Chino:				
139	C	None		
140	C	None		

water features

and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

High water table			Bedrock		Cemented pan	
Depth	Kind	Months	Depth	Hardness	Depth	Hardness
Ft			*In*		*In*	
>6.0			24–40	Rippable		
>6.0			24–40	Rippable		
>6.0			20–36	Rippable		
>6.0			24–36	Rippable		
>6.0			24–36	Rippable		
>6.0			20–36	Rippable		
>6.0			20–32	Rippable		
>6.0			24–32	Rippable		
>6.0			24–36	Rippable		
>6.0			30–40	Rippable		
>6.0			24–32	Rippable		
>6.0			24–40	Rippable		
3.0–6.0	Apparent	Feb-May	>60			
>6.0			22–36	Rippable		
>6.0			26–36	Rippable		
>6.0			26–36	Rippable		
>6.0			22–32	Rippable		
>6.0			24–30	Rippable		
>6.0			>60			
>6.0			10–19	Rippable		
>6.0			>60			
>6.0			>60		20–37	Rippable.
3.5–5.0	Apparent	Feb-May	>60			
>6.0			>60			

TABLE 11.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Cieneba:				
141, 142	C	None		
[1] 143:				
Cieneba part	C	None		
Blasingame part	C	None		
Rock outcrop part.				
[1] 144:				
Cieneba part	C	None		
Rock outcrop part.				
[1] 145:				
Cieneba part	C	None		
Rock outcrop part.				
Corralitos:				
146	A	None		
147	A	None		
Cropley:				
148, 149	D	None		
Escondido:				
150, 151	C	None		
Exchequer:				
[1] 152:				
Exchequer part	D	None		
Rock outcrop part.				
Friant:				
153	D	None		
Gabino:				
154	D	None		
Garretson:				
155	B	None		
Hanford:				
156	B	None		
Hueneme:				
157	C	Rare		
158	B	None		
Las Posas:				
159	C	None		
Laughlin:				
160	C	None		
Marina:				
161, 162	B	None		
Metz:				
163, 164	A	None		
Mocho:				
165, 166, 167	D	None		
Modjeska:				
168, 169, 170, 171	B	None		

water features—Continued

High water table			Bedrock		Cemented pan	
Depth	Kind	Months	Depth	Hardness	Depth	Hardness
Ft			*In*		*In*	
>6.0			5–19	Rippable		
>6.0			15–19	Rippable		
>6.0			20–30	Rippable		
>6.0			15–19	Rippable		
>6.0			5–15	Rippable		
>6.0			>60			
3.0–5.0	Perched	May-Sep	>60			
>6.0			>60			
>6.0			24–35	Hard		
>6.0			8–18	Hard		
>6.0			9–18	Rippable		
>6.0			26–40	Rippable		
>6.0			>60			
>6.0			>60			
3.5–5.0	Apparent	Jan-Apr	>60			
>6.0			>60			
>6.0			26–40	Rippable		
>6.0			24–40	Hard		
>6.0			>60			
>6.0			>60			
>6.0			>60			
>6.0			>60			

TABLE 11.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Myford: 172, 173, 174, 175, 176, 177, 178, 179	D	None		
Nacimiento: 180, 181	C	None		
Omni: 182, 183	D	None		
184	D	None		
Pits: 185.				
Ramona: 186, 187	B	None		
Rincon: 188, 189, 190	C	None		
Riverwash: 191.				
Rock outcrop: [1] 192: Rock outcrop part.				
Cieneba part	C	None		
San Andreas: 193	B	None		
San Emigdio: 194, 195, 196	B	None		
Soboba: 197, 198	A	None		
Soper: 199, 200, 201, 202, 203	C	None		
[1] 204: Soper part	C	None		
Rock outcrop part.				
Sorrento: 205, 206, 207, 208, 209	B	None		
Thapto-Histic Fluvaquents: 210	D	None		
Tidal flats: 211.				
Tollhouse: [1] 212: Tollhouse part	D	None		
Rock outcrop part.				
Vista: 213, 214, 215	C	None		
[1] 216: Vista part	C	None		
Rock outcrop part.				
Xeralfic Arents: 217, 218	B	None		

water features—Continued

High water table			Bedrock		Cemented pan	
Depth	Kind	Months	Depth	Hardness	Depth	Hardness
Ft			*In*		*In*	
>6.0			>60			
>6.0			24–36	Rippable		
>6.0			>60			
3.5–6.0	Apparent	Nov-Mar	>60			
>6.0			>60			
>6.0			>60			
>6.0			5–15	Rippable		
>6.0			24–32	Rippable		
>6.0			>60			
>6.0			>60			
>6.0			20–36	Rippable		
>6.0			20–24	Rippable		
>6.0			>60			
2.0–3.5	Apparent	Jan-Dec	>60			
>6.0			7–18	Rippable		
>6.0			24–40	Rippable		
>6.0			24–36	Rippable		
>6.0			>60			

TABLE 11.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Xerorthents: 219, 220	C	None		
Yorba: 221, 222, 223, 224, 225, 226	D	None		

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and

which precipitation exceeds evaporation. Thus, the small amounts of moisture of the present climate preclude active leaching. The rates of redistribution of carbonates and the translocation of clays by this process are slow. Most of the soils have a good supply of bases, and many lack prominent argillic horizons. The alternate wet and dry periods cause soils that are high in montmorillonitic clays to shrink and swell. Wide cracks form during the dry summer and close during the moist winter in such soils as the Bosanko or Alo soils. Some of the surface soil falls or washes into the cracks and mixes with the other horizons and prevents textural differentiation in the profiles.

The warm temperature when the soils are moist and generally throughout the year provides a suitable environment for rapid decomposition of organic matter and soil minerals. The soils in the surface layer are not well granulated, partly because they are not subject to freezing and thawing.

The soils are dry to a depth of 20 inches or more for several months in summer, unless irrigated. Biological and some chemical processes are retarded during this dry period. Most of the soils have a surface layer that is structureless and is crusted and hard when dry but becomes friable when moist.

Generally, differences in climate mean differences in soil properties. Increases in precipitation mean increases in organic matter, more leaching, and deeper soil profiles. The main difference in this area, however, seems to be caused by micro-climatic variations. For example, in the foothills, the Calleguas soils on the warmer, drier south-facing slopes are light colored, low in organic matter content, and shallow. Bosanko soils on north-facing slopes are dark colored, high in organic matter, and moderately deep. Similar conditions occur in the Santa Ana Mountains, where there is higher rainfall. Tollhouse soils on north-facing slopes are dark colored and high in organic matter content. Cieneba soils at about the same elevations on south-facing slopes are light colored, low in organic matter, and warmer.

The climate in the survey area is described in more detail under the heading "Environmental Factors Affecting Soil Use."

Biological activity

Living organisms, such as vegetation, burrowing animals, insects, earthworms, bacteria, fungi, other micro-organisms, and man affect the formation of soils. Plants generally have a greater influence than other living organisms on soil formation in the survey area. They provide shade, cover, and litter, thus reducing runoff and erosion, and they contribute organic matter to the soil, improving its structure, aeration, and other physical and chemical conditions. A sparse vegetative cover adds little organic matter to soils. Cieneba soils, for example, under only a scattered brush cover are low in content of organic matter and have a light colored surface layer. Alo soils, in contrast, developed under grasses and forbs, have a dark colored surface layer, and are high in content of organic matter.

The effects of burrowing animals are apparent in some soils. Scattered bits of parent material are on the surface, and the soils are loose and mixed as a result of the collapsing of the burrows. Ground squirrels prefer to burrow and nest in calcareous soils. Balcom and Calleguas soils have noticeably more burrows than other adjacent noncalcareous soils.

Earthworms loosen, aerate, and mix soils and with other micro-organisms help break down plant nutrients.

Recently, man has changed the natural processes of soil formation through cultivation, irrigation, and drainage and by numerous other means.

Time

Soil formation or development relates more to the length of time for weathering by the other four interacting forces than to age in terms of years. The geologic age of parent material has little to do with the age of soils.

The oldest soils in this area developed in old alluvium of terraces. These soils are on stable landscapes and have been in place longer than the other soils of the survey area. They are redder in color, finer in texture, and have stronger structure and more acid reactions than the surrounding younger soils. Chesterton, Myford, and Yorba are examples of old soils.

The young soils, which lack development, generally formed in recent alluvium or on upland slopes where erosion is active and new soil material is removed almost as it is weathered. Bolsa, Capistrano, and San Emigdio soils formed in recent alluvium. Calleguas, Cieneba, and Friant are examples of young upland soils. Soils having few or indistinct horizons are considered intermediate in age.

water features—Continued

High water table			Bedrock		Cemented pan	
Depth	Kind	Months	Depth	Hardness	Depth	Hardness
Ft			*In*		*In*	
>6.0			10–60	Hard		
>6.0			>60			

behavior of the whole mapping unit.

Classification of the Soils

The present Soil Classification System was adopted for general use by the National Cooperative Soil Survey in 1965 (*13, 14*). The five orders in the survey area are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols. In table 13, the soils of the survey area are classified according to the system.

Alfisols have been in place for a sufficient length of time for the movement and accumulation of silicate clays. They have massive, hard surface horizons and argillic horizons with high base saturation. In this area they are all naturally dry between May and November. Five subgroups of Alfisols are recognized in the survey area.

Entisols are young mineral soils. They lack pedogenic horizons but have ochric epipedons. Six subgroups of Entisols are recognized in the survey area.

Inceptisols are young mineral soils that have weakly developed horizons and cambic horizons, but lack other diagnostic horizons. There are two subgroups of Inceptisols in the survey area.

Mollisols have a thick, friable, dark colored surface horizon with a base saturation of 50 percent or more. In this area there are ten subgroups of Mollisols.

Vertisols are clayey soils with cracks that open and close as the soils shrink when dry and swell when wet. This area has two subgroups that dry and crack during summer.

Environmental Factors Affecting Soil Use

Orange County and the Western Part of Riverside County, the area surveyed, can be roughly divided as follows: A narrow strip of beaches and tidal flats along the coast; a gently sloping alluvial flood plain and fans in the northwest and central part of Orange County; and an area of terraces and rolling foothills adjacent to the flood plain in the northern part, west of the Santa Ana Mountains in the eastern part, and along the southern part of Orange County and extending up the coast to about Corona Del Mar. From Corona Del Mar a strip of intermittent terraces extends along the coast to Seal Beach. The steep Santa Ana Mountains extend along the east boundary of the area, mostly along the Orange and Riverside county line, and include a small part of Western Riverside County. Elevations in the area range from sea level along the coast to over 5,000 feet in the Santa Ana Mountains. Santiago Peak, in the central part of the range, has an elevation of 5,687 feet.

Soils of the alluvial flood plain and fans are very deep, have smooth surfaces, extend on gradually decreasing gradients toward the ocean, and often terminate in tidal flats. The soils in the lower parts of the plains and in the basins are naturally poorly drained or somewhat poorly drained. The soils at higher elevations are well drained or somewhat excessively drained. These are the most productive agricultural soils in the area. The terrace soils are not highly productive. They were planted to citrus, some avocados, and other crops in the past, but because of their strongly developed claypan subsoil, crops were only moderately good.

The foothill uplands are generally limited to dryland barley, pasture, and range. A few areas are used for citrus or avocados. The mountain uplands are generally used to a limited extent only for range. There are a few alluvial fans and terraces on the east side of the Santa Ana Mountains in Riverside County that are used for citrus, avocados, and other minor crops.

The principal river of the survey area is the Santa Ana River. It drains a large region 75 miles farther inland, but only a third or less of this survey area. The river enters the area near the San Bernardino, Riverside, and Orange county lines, through a narrow deep canyon called the Santa Ana Narrows. Its general course is southwest through the flood plain to the ocean at a point about 1.5 miles northwest of Newport Bay. Its principal tributary in this area is Santiago Creek, which flows out of Modjeska Canyon and drains most of the northwest area of the Santa Ana Mountains. The drainage of the northeast half of the Santa Ana Mountains also flows into the Santa Ana River near Corona in Riverside County. The Santa Ana River and Santiago Creek have major flood control dams that protect much of the flood plain area in Orange County. The San Gabriel River flows in a southerly direction just west of the northwest boundary of the survey area and empties just south of Alamitos Bay. Coyote Creek drains a small section of the northwestern part of the area and joins the San Gabriel west of the city of Los Alamitos.

Aliso, Trabuco, and San Juan Creeks drain large

TABLE 12.—*Engineering*

Soil name and location	Report No.	Depth (in.)	Moisture-density [1]		Percentage passing sieve [2]			
			Maximum dry density	Optimum moisture	2 in.	1½ in.	1 in.	¾ in.
			pcf	*Pct*				
Alo clay:								
NE¼, NE¼, sec. 100, T. 6S., R. 9W.[5]	6413	8–19	111	17				
	6414	33–37	117	16				
Alo Variant clay:								
SW¼, NE ¼, sec. 41, T. 5S., R. 8W.[5]	6408	10–22	116	14				
	6409	40–48	124	12				
Bolsa silt loam:								
NE¼, NW¼, sec. 45, T. 7S., R. 9W.[5]	6398	10–17	112	16				
Bosanko clay:								
NE¼, SE¼, sec. 10, T. 7S., R. 8W.	6415	12–21	106	17				
	6416	42–56	104	18				
Botella clay loam:								
NW¼, NE¼, sec. 6, T. 6S., R. 7W. (modal)	6418	0–3	106	19				100
	6419	8–24	108	17				
Capistrano sandy loam:								
NW¼, NW¼, sec. 152, T. 5S., R. 8W.[5]	6417	11–19	126	11				100
Chino silty clay loam:								
NW¼, NW¼, sec. 9, T. 5S., R. 9W.	6399	9–17	112	15				
Cieneba sandy loam:								
NE¼, NE¼, sec. 142, T. 5S., R. 8W.[5]	6402	16–29	124	11				100
Gabino cobbly clay loam:								
SW¼, SW¼, sec. 9, T. 7S., R. 6W.[7]	3186	0–7	117	14	100	99	97	94
	3187	12–17	116	14		100	96	96
	3188	22–30	116	14	100	99	95	92
Hueneme fine sandy loam:								
NW¼, NW¼, sec. 18, T. 6S., R. 10W. (modal)	3178	5–23	118	14				
	3179	23–30	101	19				
Marina loamy sand:								
NW¼, SE¼, sec. 21, T. 8S., R. 8W. (modal)	3183	0–7	113	14				
	3184	33–56	121	10				
	3185	60–80	117	13				
Metz loamy sand:								
SW¼, NE¼, sec. 108, T. 5S., R. 8W.[5]	6404	10–17	122	15				
Mocho loam:								
NW¼, NW¼, sec. 44, T. 5S., R. 9W.[5]	6397	9–17	112	15				
Myford sandy loam:								
NE¼, SE¼, sec. 112, T. 7S., R. 8W.[5]	6410	12–17	118	11				
	6411	17–30	113	14				
	6412	42–52	117	12				
Omni clay:								
NW¼, SE¼, sec. 62, T. 5S., R. 9W.[5]	3192	6–9	105	19				
	3193	25–49	102	21				
San Emigdio fine sandy loam:								
NE¼, NE¼, sec. 142, T. 5S., R. 7W.[5]	6101	11–16	112	19				

test data

Percentage passing sieve [2]—Contd.					Liquid limit	Plasticity index	Classification	
⅜ in.	No. 4	No. 10	No. 40	No. 200			AASHTO [3]	Unified [4]
		100	98	77	49	32	A–7–6(25)	CL
		100	90	30		[6] NP	A–2–4(0)	SM
100	99	97	84	56	45	25	A–7–6(11)	CL
100	99	94	63	25		NP	A–2–4(0)	SM
		100	90	64	35	11	A–6(6)	CL–ML
				94	58	36	A–7–6(38)	CH
		100	98	92	57	33	A–7–6(34)	CH
99	99	97	89	63	36	14	A–6(7)	CL
	100	98	92	70	39	19	A–6(12)	CL
99	97	94	75	32		NP	A–2–4(0)	SM
		100	99	86	43	19	A–7–6(19)	CL
99	98	92	51	11	61	NP	A–2–4(0)	SW–SM
87	80	72	59	44	50	26	A–7–6(7)	SC
94	92	88	80	60	59	34	A–7–6(20)	CH
88	83	75	60	44	59	32	A–7–6(9)	SC
		100	99	63		NP	A–4(0)	ML
		100	99	29		NP	A–2–4(0)	SM
		100	70	11		NP	A–2–4(0)	SW–SM
		100	68	14		NP	A–2–4(0)	SM
		100	74	12		NP	A–2–4(0)	SM
100	99	97	82	30		NP	A–2–4(0)	SM
		100	98	82	37	15	A–6(12)	CL
	100	98	84	47		NP	A–4(0)	SM
		100	93	72	43	27	A–7–6(18)	CL
	100	99	93	70	36	15	A–6(10)	CL
		100	98	80	62	42	A–7–6(35)	CH
	100	99	97	86	80	59	A–7–6(56)	CH
100	99	97	88	40		NP	A–4(0)	SM

TABLE 12.—*Engineering*

Soil name and location	Report No.	Depth (in.)	Moisture-density [1]		Percentage passing sieve [2]			
			Maximum dry density	Optimum moisture	2 in.	1½ in.	1 in.	¾ in.
			pcf	*Pct*				
Soper gravelly loam: NE¼, SW¼, sec. 119, T. 5S., R. 7W.[5]	3189	3–12	130	9		100	97	96
	3190	17–21	126	11		100	98	95
	3191	25–37	129	10		100	99	99
Sorrento loam: SW¼, SW¼, sec. 120, T. 5S., R. 8W. (modal)[5]	6403	12–21	121	12				
Thapto-Histic Fluvaquents: NE¼, NE¼, sec. 142, T. 5S., R. 7W.[5]	6400	9–14	61	48				
Yorba gravelly sandy loam: SE¼, SW¼, sec. 173, T. 6S., R. 8W.[5]	6405	0–3	127	9	100	98	96	94
	6406	9–18	112	12			100	99
	6407	28–42	125	11			100	99

[1] Based on the Moisture-density Relations of Soils Using 5.5-lb. Rammer and 12-in. Drop, AASHTO Designation T 99, Method A.
[2] Mechanical analyses according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 mm. in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 mm. in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

parts of the southwest section of the area. There are no major flood control dams on these creeks.

Climate

The climate of the survey area is typical of the Southern California Coastal Region. Winters are cool and moist; nearly all the precipitation falls in winter. Summers are mild, warm, and dry. Light fogs or clouds, or both, are common along the coast late in spring and early in summer but rarely remain during the entire day. Some fog generally occurs every month of the year. Maximum summer temperatures seldom exceed 90° F, and nights generally are cool throughout the year. Winter temperatures are seldom below freezing in most of the area.

On the alluvial flood plain, the frost hazard is low and only in a few of the colder areas is frost protection by wind machines or orchard heaters required to protect citrus.

Damaging winds are infrequent. Sometimes, northeast winds known as "Santa Ana's" occur for short periods. These winds are accompanied by low humidity and above average temperature. They can be somewhat detrimental to most agricultural crops. Hazardous fire conditions generally prevail on range and brushland during these periods.

Average mean annual rainfall at most of the lower elevations in the survey area is about 14 inches. Precipitation, mostly rainfall, increases considerably at the higher elevations in the Santa Ana Mountains and often exceeds 25 to 30 inches annually around Santiago Peak. Infrequent, light snowfall occurs on some of the higher mountain peaks. The annual rainfall on the east-facing slopes of the Santa Ana Mountains drops rapidly to an average of about 12 inches at the lower elevations.

Temperatures vary from very little fluctuation along the coastline because of the ocean to a much wider range in the high Santa Ana Mountain area. The area can be divided into five temperature zones (7):

(1) The Shoreline Zone, extending along the base of cliffs and in a few places several miles inland, is dominated by the ocean. Winter temperatures average 52° and high temperatures in summer average about 68°. Mean annual air temperature at Newport Beach is about 61°.

(2) The Nearshore Zone, extending to cold air basins and hilltops above air drained slopes, is also heavily influenced by the ocean and is only slightly warmer than the shoreline. Summer temperatures average 68°, and winter temperatures about 53°. Winter temperatures rarely drop lower than 30°.

(3) The Flatland-Foothill Zone has somewhat less ocean influence. Thus, daily and seasonal temperature variations are significantly greater in the inland zones. The daily winter temperature averages 54°. The average daily low is usually about 34°, but is occasionally in the lower twenties. This zone, encompassing more than half the area, usually is warmer during the summer and colder during winter than the immediate coastal zones. In Santa Ana, for example, the mean annual temperature is 62°. Extremes of 22° and 112° have been recorded.

(4) The Santa Ana Mountains (Foothills) Thermal

test data—Continued

Percentage passing sieve [2]—Cont'd.					Liquid limit	Plasticity index	Classification	
⅜ in.	No. 4	No. 10	No. 40	No. 200			AASHTO [3]	Unified [4]
92	88	83	64	33		NP	A–2–4(0)	SM
92	90	85	67	35	30	12	A–2–6(1)	SC
89	94	89	65	25		NP	A–2–4(0)	SM
	100	99	86	52	32	11	A–6(3)	CL
	100	97	80	65	103	27	A–7–6 (24) A–8	OH
89	87	83	62	28		NP	A–2–4(0)	SM
98	97	92	71	37	38	19	A–6(3)	SC
98	97	92	72	27		NP	A–2–4(0)	SM

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145–49.

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3–357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

[5] Private cadastral survey that does not meet standards of U.S. Geological Survey, Topographic Division.

[6] NP—Nonplastic.

[7] Cobbles discarded. Estimated at 3 percent by volume of surface layer.

Belt Zone is only slightly influenced by the ocean, and extreme temperatures are more diverse than in the previously mentioned zones. The average annual temperature is about 63° F. Good air drainage off the hilly slopes insures long, no-frost crop growing periods each year.

(5) The Santa Ana Mountains Non-Thermal Zone is the highest elevation region in the mountains above the thermal belts. This zone has cold winters, occasional snowfall, and temperatures sometimes below 20°. The annual temperature is about 57° on the north-facing slopes and only slightly higher on the southern exposures.

Water Supply

The main source of water in the survey area is imported from the Colorado River. The imported supply of Northern California water is minimal now but can be substantially increased in the near future. Much of the imported water is used to recharge the ground water supply. About 60 to 75 percent of the ground water pumped from the Santa Ana River Recharge area is considered to be imported, and about 25 percent is local watershed recharge water. Intrusions of salt-water have affected the quality in ground water near the coast in some areas.

Other major urban and agricultural areas outside the Santa Ana River zone also import 70 percent or more of the water. The small agricultural area on the lower east-facing slopes of the Santa Ana Mountains and a few other isolated areas depend mostly on ground water and surface runoff for the irrigation needs.

Natural Vegetation

Before man, this area was probably large areas of native grasses and thick oak forests that extended down the mountains to rolling hills of sagebrush and chaparral. Below the hills were valleys of cottonwoods, oaks, sycamore, alder, ferns, and currants. Each region had its own natural community of plants, mammals, birds, insects, and other organisms.

For centuries, the landscape showed relatively little change. With the first settlers, however, came the destructive misuse of the land. Overgrazing, fires started by man, and the resulting floods and erosion scarred the land. As farming became more intensive, native plants were replaced by domestic plants. Today this area is undergoing continual change—expanding urbanization and also farming in a few new zones.

Transportation Facilities

This area has good air, bus, truck, and rail service facilities. The Orange County Airport has several major commercial airlines providing daily flights throughout the State. It also has a regularly scheduled air commuter service to numerous points throughout the South. Major cities in the area are served by buses operated by the Orange County Transit District. Many cities also have local bus service. Two major buslines connect the area with national routes. Major trucklines provide service throughout the area. The Santa Fe Railroad services many of the major cities. A network of freeways, highways, and other major roads provides for private automobile travel within the survey area.

TABLE 13.—*Classification of the soils*

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Alo	Fine, montmorillonitic, thermic Typic Chromoxererts
Alo Variant	Fine, montmorillonitic, thermic Typic Chromoxererts
Anaheim	Fine-loamy, mixed, thermic Pachic Haploxerolls
Balcom	Fine-loamy, mixed, thermic Calcixerollic Xerochrepts
Blasingame	Fine-loamy, mixed, thermic Typic Haploxeralfs
Bolsa	Fine-silty, mixed (calcareous), thermic Aquic Xerofluvents
Bosanko	Fine, montmorillonitic, thermic Chromic Pelloxererts
*Botella	Fine-loamy, mixed, thermic Pachic Argixerolls
Calleguas	Loamy, mixed (calcareous), thermic, shallow Typic Xerorthents
Capistrano	Coarse-loamy, mixed, thermic Entic Haploxerolls
*Chesterton	Fine, kaolinitic, thermic Abruptic Durixeralfs
Chino	Fine-loamy, mixed, thermic Aquic Haploxerolls
Cieneba	Loamy, mixed, nonacid, thermic, shallow Typic Xerorthents
Corralitos	Mixed, thermic Typic Xeropsamments
Cropley	Fine, montmorillonitic, thermic Chromic Pelloxererts
Escondido	Coarse-loamy, mixed, thermic Typic Xerochrepts
Exchequer	Loamy, mixed, nonacid, thermic Lithic Xerorthents
Friant	Loamy, mixed, thermic Lithic Haploxerolls
Gabino	Fine, montmorillonitic, thermic Typic Argixerolls
Garretson	Fine-loamy, mixed, nonacid, thermic Typic Xerorthents
Hanford	Coarse-loamy, mixed, nonacid, thermic Typic Xerorthents
Hueneme	Coarse-loamy, mixed (calcareous), thermic Aquic Xerofluvents
Las Posas	Fine, montmorillonitic, thermic Typic Rhodoxeralfs
*Laughlin	Fine-loamy, mixed, mesic Ultic Haploxerolls
Marina	Mixed, thermic Alfic Xeropsamments
Metz	Sandy, mixed, thermic Typic Xerofluvents
Mocho	Fine-loamy, mixed, thermic Fluventic Haploxerolls
Modjeska	Loamy-skeletal, mixed, thermic Typic Xerochrepts
Myford	Fine-loamy, mixed, thermic Typic Palexeralfs
Nacimiento	Fine-loamy, mixed, thermic Calcic Haploxerolls
Omni	Fine, montmorillonitic (calcareous), thermic Fluvaquentic Haplaquolls
Ramona	Fine-loamy, mixed, thermic Typic Haploxeralfs
Rincon	Fine, montmorillonitic, thermic Mollic Haploxeralfs
*San Andreas	Coarse-loamy, mixed, thermic Typic Haploxerolls
San Emigdio	Coarse-loamy, mixed (calcareous), thermic Typic Xerofluvents
Soboba	Sandy-skeletal, mixed, thermic Typic Xerofluvents
Soper	Fine-loamy, mixed, thermic Typic Argixerolls
Sorrento	Fine-loamy, mixed, thermic Calcic Haploxerolls
Thapto-Histic Fluaquents	Thapto-Histic Fluvaquents
Tollhouse	Loamy, mixed, mesic, shallow Entic Haploxerolls
Vista	Coarse-loamy, mixed, thermic Typic Xerochrepts
Xeralfic Arents	Xeralfic Arents
Xerorthents	Xerorthents
Yorba	Loamy-skeletal, mixed, thermic Typic Haploxeralfs

Manufacturing and Business Services

Principal industries in the area today, beside agriculture, are the petroleum industry, building construction, electronics, electrical equipment, medical equipment, aerospace, plastics, boatbuilding, and food processing firms. Sand, gravel, and clay are major mining industries.

Trends in Soil Use

In 1776, Mission San Juan Capistrano was founded. From this time of Spanish settlement until about 1863, cattle raising on large ranches was the main agricultural enterprise. The drought of 1863, however, caused a severe feed shortage and many cattle died on the range. At this time the California legislature passed the closure law, which required that cattlemen keep their livestock away from the cultivated lands. Because the drought and this law discouraged cattle raising, many of the larger ranches were broken up into smaller units.

Grapes and deciduous fruits became important crops between 1860 and 1890. Irrigation developed rapidly during this period. About 1890, however, the grape industry was nearly destroyed by the Anaheim vine disease, and it has not been reestablished in the area. Sugar beets, beans, and other irrigated fruit and truck crops have had various periods of success. Beginning about 1920, many of the fruit and walnut groves were replaced by citrus groves. Since World War II, extremely rapid urban and industrial expansion have drastically reduced the agricultural acreage in the area.

Because of the large urban market for ornamental plants in this area and surrounding areas, nursery stock has become the principal agricultural crop in the entire survey area. Strawberries, Valencia oranges, tomatoes, celery, cauliflower, sweet corn, asparagus,

and avocados are still major crops. Since this area is expected to continue to be the fastest growing area in California, the trend will be towards more industry and trade centers and fewer farms.

Literature Cited

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487–69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Bureau of Sport Fisheries and Wildlife. 1973. Threatened wildlife of the United States. Resour. Publ. 114, 289 pp., illus.

(4) California Department of Fish and Game. 1972. At the crossroads—a report on California's endangered and rare fish and wildlife, 99 pp., illus.

(5) California Department of Natural Resources, Division of Mines. 1954. Geology of southern California. Bull. 170, pp. 65–80, illus.

(6) Munz, Philip A., and David D. Keck. 1963. A California flora. Univ. Calif. Press, p. 13.

(7) Orange County Planning Department. 1972. The physical environment of Orange County. 147 pp., illus.

(8) Shaw, Samuel P. and Fredine, C. Gordon. 1956. Wetlands of the United States. Resour. Publ. 114.

(9) Storie, R. E. 1933. An index for rating agricultural value of soil. Calif. Agric. Exp. Stn. Bull. 566, 48 pp., illus. [Revised 1937, 1944, 1953.]

(10) Storie, R. E. 1953. Revision of the soil rating chart. Calif. Agric. Exp. Stn. 4 pp., illus.

(11) Storie, R. E. 1964. Handbook of soil evaluation. Assoc. Students Store, Univ. Calif., Berkeley, Calif. 225 pp.

(12) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173–188 issued May 1962]

(13) United States Department of Agriculture. 1960. Soil classification, a comprehensive system, 7th approximation. Soil Conserv. Serv., 265 pp., illus. [Supplements issued March 1967, September 1968, April 1969.]

(14) United States Department of Agriculture. 1974. Soil taxonomy, a basic system of soil classification for making and interpreting soil surveys. 330 pp.

(15) Wishmeir, W. H., C. D. Johnson, and B. V. Cross. 1971. Journal of soil and water conservation. pp. 189–193, illus.

Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is

saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leaching. The removal of soluble material from soil or other material by percolating water.

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

pH value. (*See* Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one

mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope classes. As used in this survey—

	Range in slope *Percent*
Nearly level	0–2
Gently sloping to moderately sloping	2–9
Strongly sloping	9–15
Moderately steep	15–30
Steep	30–50
Very steep	50–75

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: very coarse sand (2.0 millimeters to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.005 to 0.002 millimeter); and clay (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

ORANGE AND WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA

Scale 1:126,720
1 0 1 2 3 4 Miles

N

SOIL ASSOCIATIONS*

SOMEWHAT EXCESSIVELY DRAINED TO POORLY DRAINED, NEARLY LEVEL TO MODERATELY SLOPING SOILS ON ALLUVIAL FANS AND FLOOD PLAINS AND IN BASINS OF THE COASTAL PLAINS

1 Chino-Omni association: Nearly level, somewhat poorly drained and poorly drained, calcareous silt loams to clays on alluvial fans and flood plains and in basins

2 Hueneme-Bolsa association: Nearly level, poorly drained and somewhat poorly drained, calcareous fine sandy loams, silt loams, and silty clay loams on alluvial fans and flood plains

3 Metz-San Emigdio association: Nearly level, somewhat excessively drained and well drained, calcareous loamy sands and fine sandy loams on alluvial fans and flood plains

4 Sorrento-Mocho association: Nearly level to moderately sloping, well drained sandy loams, loams, or clay loams on alluvial fans and flood plains

MODERATELY WELL DRAINED, NEARLY LEVEL TO MODERATELY STEEP SOILS OF THE COASTAL TERRACES

5 Myford association: Nearly level to moderately steep, moderately well drained sandy loams that have a strongly developed subsoil; on terraces

SOMEWHAT EXCESSIVELY DRAINED AND WELL DRAINED, STRONGLY SLOPING TO VERY STEEP SOILS OF THE COASTAL FOOTHILLS

6 Alo-Bosanko association: Strongly sloping to steep, well drained clays on coastal foothills

7 Cieneba-Anaheim-Soper association: Strongly sloping to very steep, somewhat excessively drained and well drained sandy loams, loams, clay loams, gravelly loams, and cobbly loams on coastal foothills

SOMEWHAT EXCESSIVELY DRAINED AND WELL DRAINED, STRONGLY SLOPING TO VERY STEEP SOILS OF THE SANTA ANA MOUNTAINS

8 Friant-Cieneba-Exchequer association: Strongly sloping to very steep, somewhat excessively drained and well drained fine sandy loams, sandy loams, and gravelly silt loams on mountains

WELL DRAINED, GENTLY SLOPING TO STRONGLY SLOPING SOILS ON TERRACES AND ALLUVIAL FANS IN THE SANTA ANA MOUNTAINS

9 Ramona-Hanford association: Gently sloping to strongly sloping, well drained fine sandy loams, gravelly fine sandy loams, and sandy loams on terraces and alluvial fans

*Textures in names of associations refer to the surface layer of the major soils.

Compiled 1977

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

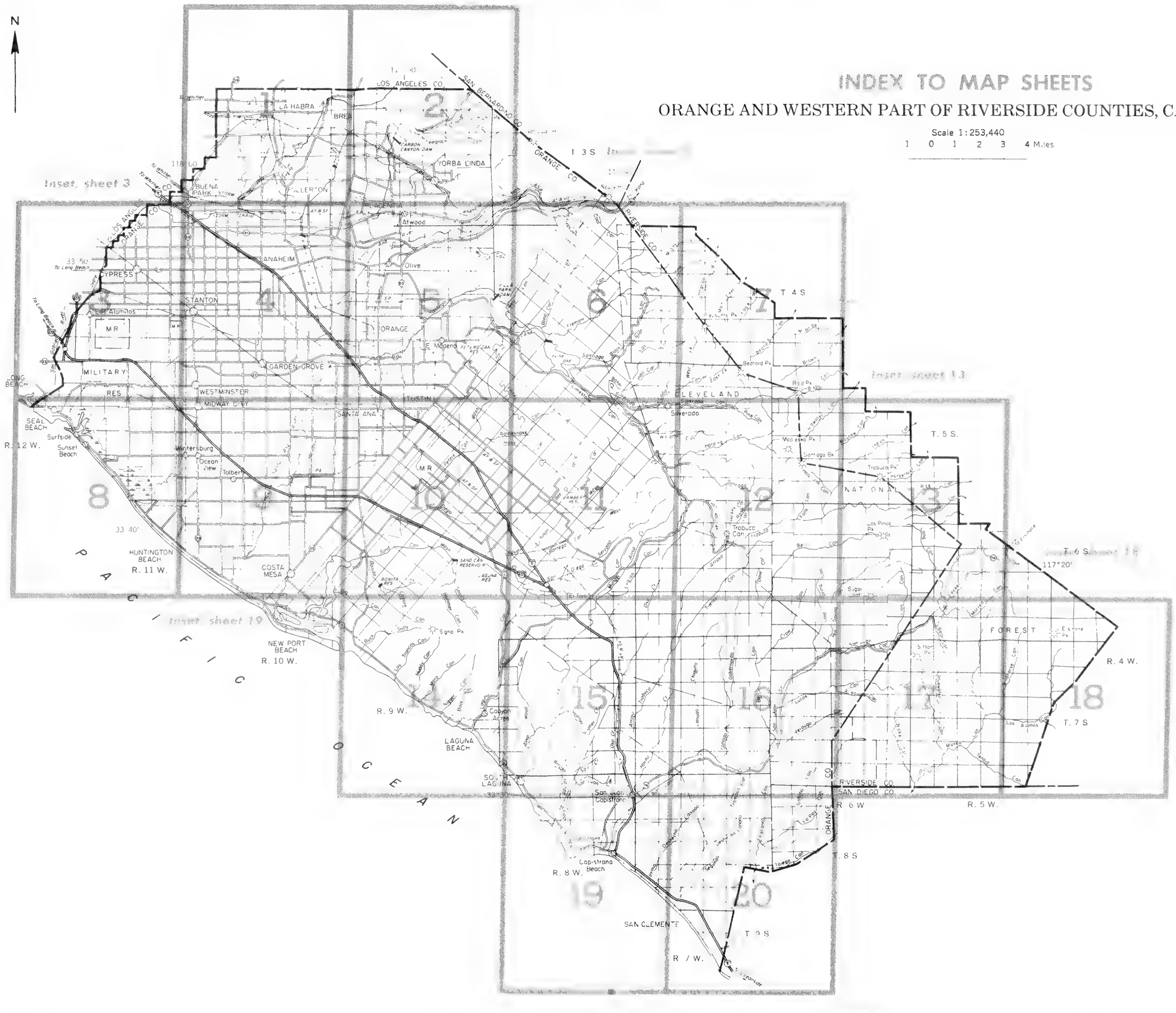
6	5	4	3	2	1	
7	8	9	10	11	12	
18	17	16	15	14	13	
19	20	21	22	23	24	
30	29	28	27	26	25	
31	32	33	34	35	36	

INDEX TO MAP SHEETS

ORANGE AND WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA

Scale 1:253,440

1 0 1 2 3 4 Miles



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

SYMBOL	NAME
100	Alo clay 9 to 15 percent slopes
101	Alo clay, 15 to 30 percent slopes
102	Alo clay, 30 to 50 percent slopes
103	Alo variant clay, 9 to 15 percent slopes
104	Alo variant clay, 15 to 30 percent slopes
105	Alo variant clay, 30 to 50 percent slopes
106	Anaheim loam, 15 to 30 percent slopes
107	Anaheim loam, 30 to 50 percent slopes
108	Anaheim clay loam, 15 to 30 percent slopes
109	Anaheim clay loam, 30 to 50 percent slopes
110	Anaheim clay loam, 50 to 75 percent slopes
111	Balcom clay loam, 9 to 15 percent slopes
112	Balcom clay loam, 15 to 30 percent slopes
113	Balcom clay loam, 30 to 50 percent slopes
114	Balcom-Rock outcrop complex, 15 to 50 percent slopes
115	Beaches
116	Blasingame loam, 9 to 30 percent slopes
117	Blasingame stony loam, 9 to 30 percent slopes
118	Blasingame stony loam, 30 to 65 percent slopes
119	Blasingame-Rock outcrop complex, 9 to 30 percent slopes
120	Blasingame-Vista complex, 9 to 15 percent slopes
121	Blasingame-Vista complex, 15 to 30 percent slopes
122	Bolsa silt loam
123	Bolsa silt loam, drained
124	Bolsa silty clay loam
125	Bolsa silty clay loam, drained
126	Bosanko clay, 9 to 15 percent slopes
127	Bosanko clay, 15 to 30 percent slopes
128	Bosanko clay, 30 to 50 percent slopes
129	Bosanko-Balcom complex, 15 to 30 percent slopes
130	Bosanko-Balcom complex, 30 to 50 percent slopes
131	Botella loam, 2 to 9 percent slopes
132	Botella clay loam, 2 to 9 percent slopes
133	Botella clay loam, 9 to 15 percent slopes
134	Calleguas clay loam, 50 to 75 percent slopes, eroded
135	Capistrano sandy loam, 2 to 9 percent slopes
136	Capistrano sandy loam, 9 to 15 percent slopes
137	Chesterton loamy sand, 2 to 15 percent slopes
138	Chesterton loamy sand, 15 to 30 percent slopes
139	Chino silty clay loam
140	Chino silty clay loam, drained
141	Cieneba sandy loam, 15 to 30 percent slopes
142	Cieneba sandy loam, 30 to 75 percent slopes, eroded
143	Cieneba-Blasingame-Rock outcrop complex, 9 to 30 percent slopes
144	Cieneba-Rock outcrop complex, 9 to 30 percent slopes
145	Cieneba-Rock outcrop complex, 30 to 75 percent slopes
146	Corralitos loamy sand
147	Corralitos loamy sand, moderately fine substratum
148	Cropley clay, 0 to 2 percent slopes
149	Cropley clay, 2 to 9 percent slopes
150	Escondido very fine sandy loam, 9 to 15 percent slopes
151	Escondido very fine sandy loam, 15 to 30 percent slopes
152	Exchequer-Rock outcrop complex, 30 to 75 percent slopes
153	Friant fine sandy loam, 30 to 70 percent slopes
154	Gabino gravelly clay loam, 15 to 50 percent slopes
155	Garretson gravelly very fine sandy loam, 2 to 9 percent slopes
156	Hanford sandy loam, 2 to 9 percent slopes
157	Hueneme fine sandy loam
158	Hueneme fine sandy loam, drained
159	Las Posas gravelly loam, 15 to 50 percent slopes
160	Laughlin gravelly loam, 30 to 50 percent slopes
161	Marina loamy sand, 0 to 2 percent slopes
162	Marina loamy sand, 2 to 9 percent slopes
163	Metz loamy sand
164	Metz loamy sand, moderately fine substratum
165	Mocho sandy loam, 0 to 2 percent slopes
166	Mocho loam, 0 to 2 percent slopes
167	Mocho loam, 2 to 9 percent slopes
168	Modjeska gravelly loam, 0 to 2 percent slopes
169	Modjeska gravelly loam, 2 to 9 percent slopes
170	Modjeska gravelly loam, 9 to 15 percent slopes
171	Modjeska gravelly loam, 15 to 30 percent slopes
172	Myford sandy loam, 0 to 2 percent slopes
173	Myford sandy loam, 2 to 9 percent slopes
174	Myford sandy loam, 2 to 9 percent slopes, eroded
175	Myford sandy loam, 9 to 15 percent slopes
176	Myford sandy loam, 15 to 30 percent slopes
177	Myford sandy loam, 9 to 30 percent slopes, eroded
178	Myford sandy loam, thick surface, 0 to 2 percent slopes
179	Myford sandy loam, thick surface, 2 to 9 percent slopes
180	Nacimiento clay loam, 15 to 30 percent slopes
181	Nacimiento clay loam, 30 to 50 percent slopes
182	Omni silt loam, drained
183	Omni clay
184	Omni clay, drained
185	Pits
186	Romona fine sandy loam, 2 to 9 percent slopes
187	Ramona gravelly fine sandy loam, 9 to 15 percent slopes
188	Rincon clay loam, 2 to 9 percent slopes
189	Rincon clay loam, 9 to 15 percent slopes
190	Rincon clay loam, 15 to 30 percent slopes
191	Riverwash
192	Rock outcrop-Cieneba complex, 30 to 75 percent slopes
193	San Andreas sandy loam, 15 to 30 percent slopes
194	San Emigdio fine sandy loam, 0 to 2 percent slopes
195	San Emigdio fine sandy loam, 2 to 9 percent slopes
196	San Emigdio fine sandy loam, moderately fine substratum, 0 to 2 percent slopes
197	Soboba gravelly loamy sand, 0 to 5 percent slopes
198	Soboba cobbly loamy sand, 0 to 15 percent slopes
199	Soper loam, 15 to 30 percent slopes
200	Soper loam, 30 to 50 percent slopes
201	Soper gravelly loam, 15 to 30 percent slopes
202	Soper gravelly loam, 30 to 50 percent slopes
203	Soper cobbly loam, 15 to 50 percent slopes
204	Soper-Rock outcrop complex, 30 to 75 percent slopes
205	Sorrento sandy loam, 0 to 2 percent slopes
206	Sorrento loam, 0 to 2 percent slopes
207	Sorrento loam, 2 to 9 percent slopes
208	Sorrento clay loam, 0 to 2 percent slopes
209	Sorrento clay loam, 2 to 9 percent slopes
210	Thapto-Histic Fluvaquents
211	Tidal flats
212	Tollhouse-Rock outcrop complex, 30 to 75 percent slopes
213	Vista coarse sandy loam, 9 to 15 percent slopes
214	Vista coarse sandy loam, 15 to 30 percent slopes
215	Vista coarse sandy loam, 30 to 65 percent slopes
216	Vista-Rock outcrop complex, 9 to 30 percent slopes
217	Xeralfic Arents, loamy, 2 to 9 percent slopes
218	Xeralfic Arents, loamy, 9 to 15 percent slopes
219	Xerorthents loamy, cut and fill areas, 9 to 15 percent slopes
220	Xerorthents loamy, cut and fill areas, 15 to 30 percent slopes
221	Yorba gravelly sandy loam, 2 to 9 percent slopes
222	Yorba gravelly sandy loam, 9 to 15 percent slopes
223	Yorba gravelly sandy loam, 15 to 30 percent slopes
224	Yorba cobbly sandy loam, 9 to 30 percent slopes
225	Yorba cobbly sandy loam, 9 to 30 percent slopes, eroded
226	Yorba cobbly sandy loam, 30 to 50 percent slopes

ORANGE AND WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

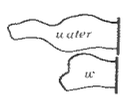
FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small



PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

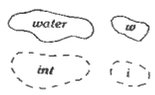
WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent



MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

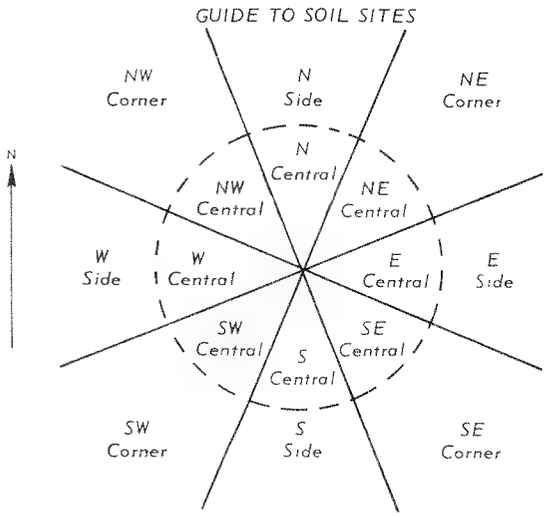
SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Cobbly spot
- Sandy loam

Soil	Map-Sheet	Location
Alo Series	10	South Side
Alo Variant	15	N. W. Corner
Anaheim Series	Inset Sheet #8	East Side of Inset
Balcom Series	15	N. E. Corner
Blasingame Series	12	West Central
Bolsa Series	9	S. W. Corner
Bosanko Series	11	S. E. Corner
Botella Series	15	N. E. Corner
Calleguas Series	14	N. W. Corner
Capistrano Series	11	South Central
Chesterton Series	15	S. W. Corner
Chino Series	10	North Central
Cieneba Series	13	S. W. Corner
Corralitos Series	16	S. W. Corner
Cropley Series	11	S. E. Corner
Escondido Series	17	West Central
Exchequer Series	12	N. E. Corner
Friant Series	12	N. E. Central
Gabino Series	16	S. E. Corner
Garretson Series	7	S. E. Corner
Hanford Series	13	S. E. Corner
Hueneme Series	9	S. W. Corner
Las Posas Series	17	East Side
Laughlin Series	12	N. E. Central
Marina Series	19	N. W. Central
Metz Series	11	N. W. Corner
Mocho Series	10	N. W. Corner
Modjeska Series	12	S. W. Corner
Myford Series	11	S. W. Corner
Nacimiento Series	Inset Sheet #8	East Side of Inset
Omni Series	9	East Side
Ramona Series	17	North Central
Rincon Series	2	West Side
San Andreas Series	11	North Side
San Emigdio Series	11	N. W. Central
Soboba Series	16	S. E. Corner
Soper Series	11	N. W. Corner
Sorrento Series	11	West Side
Thapto-Histic Fluvaquents	10	S. W. Central
Tollhouse Series	13	N. W. Corner
Vista Series	13	S. W. Corner
Yorba Series	5	East Side

GUIDE TO SOIL SITES



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

2 Miles 1 ¾ ½ ¼ 0
5000 4000 3000 2000 1000 0
Scale 1:24000
5000 10000 Feet

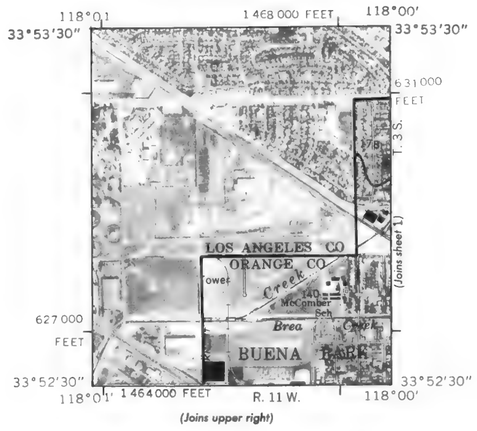
Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

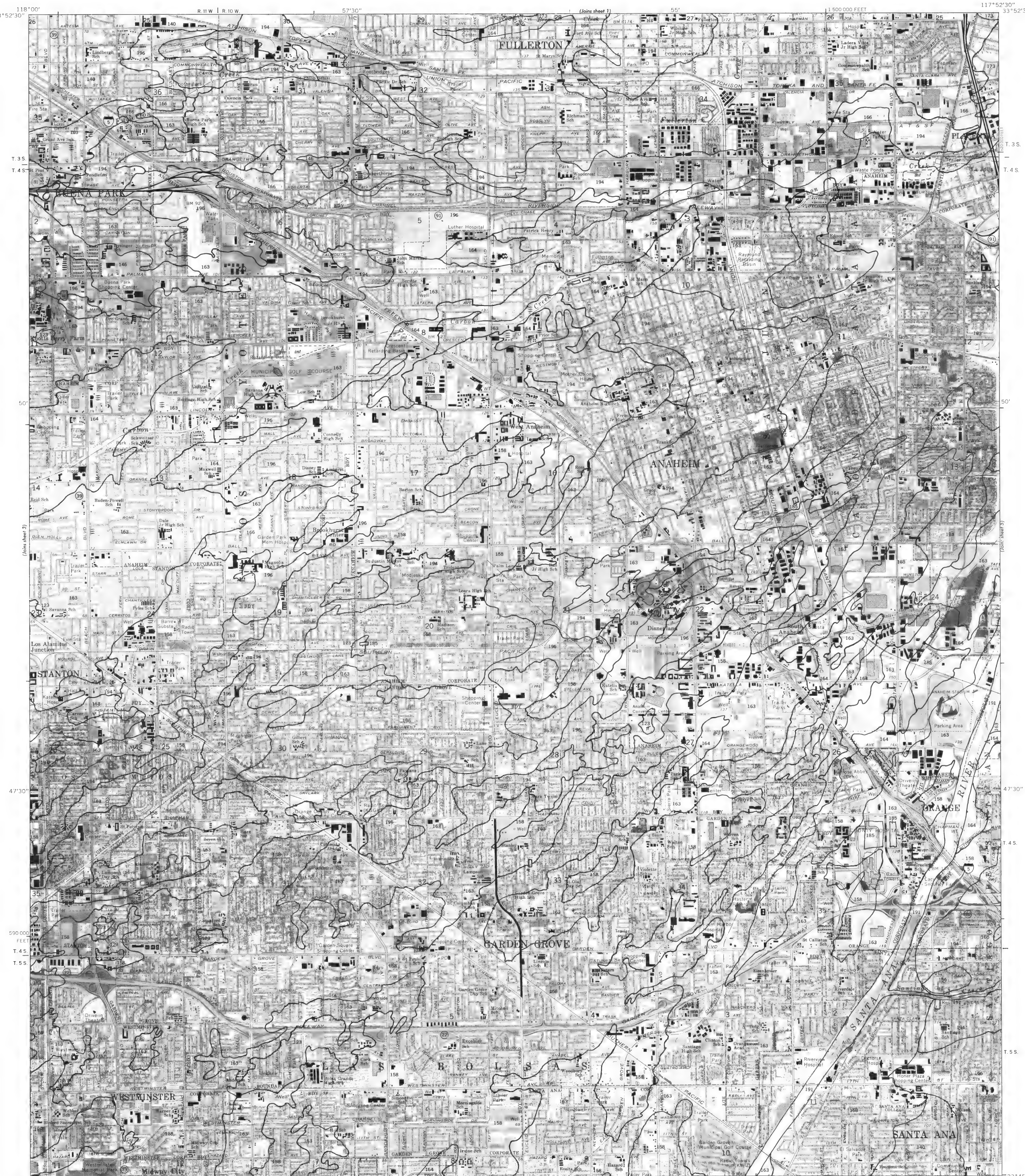
ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 2



This soil survey was compiled in1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



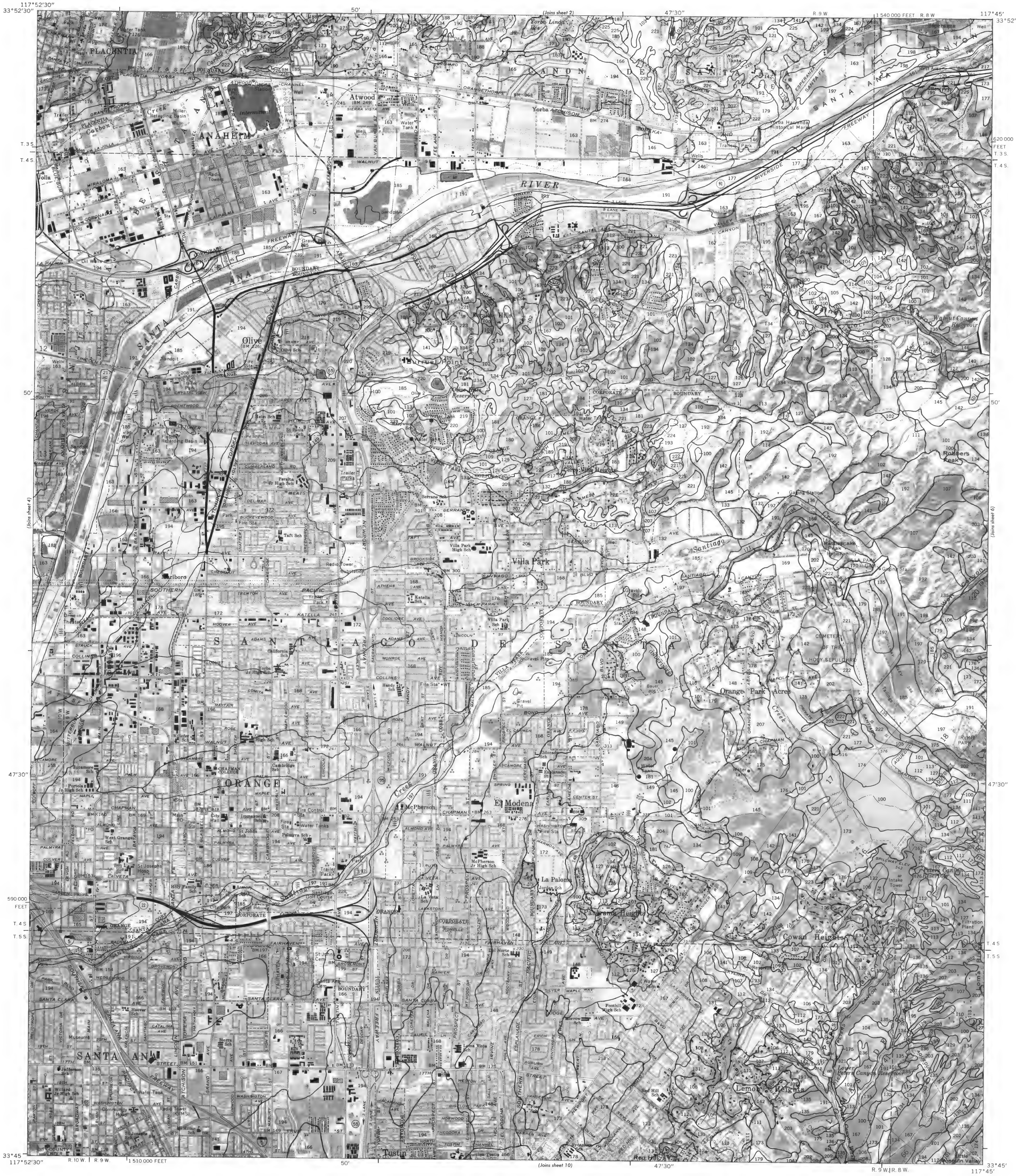
Scale 1:24 000

1 ½ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24000

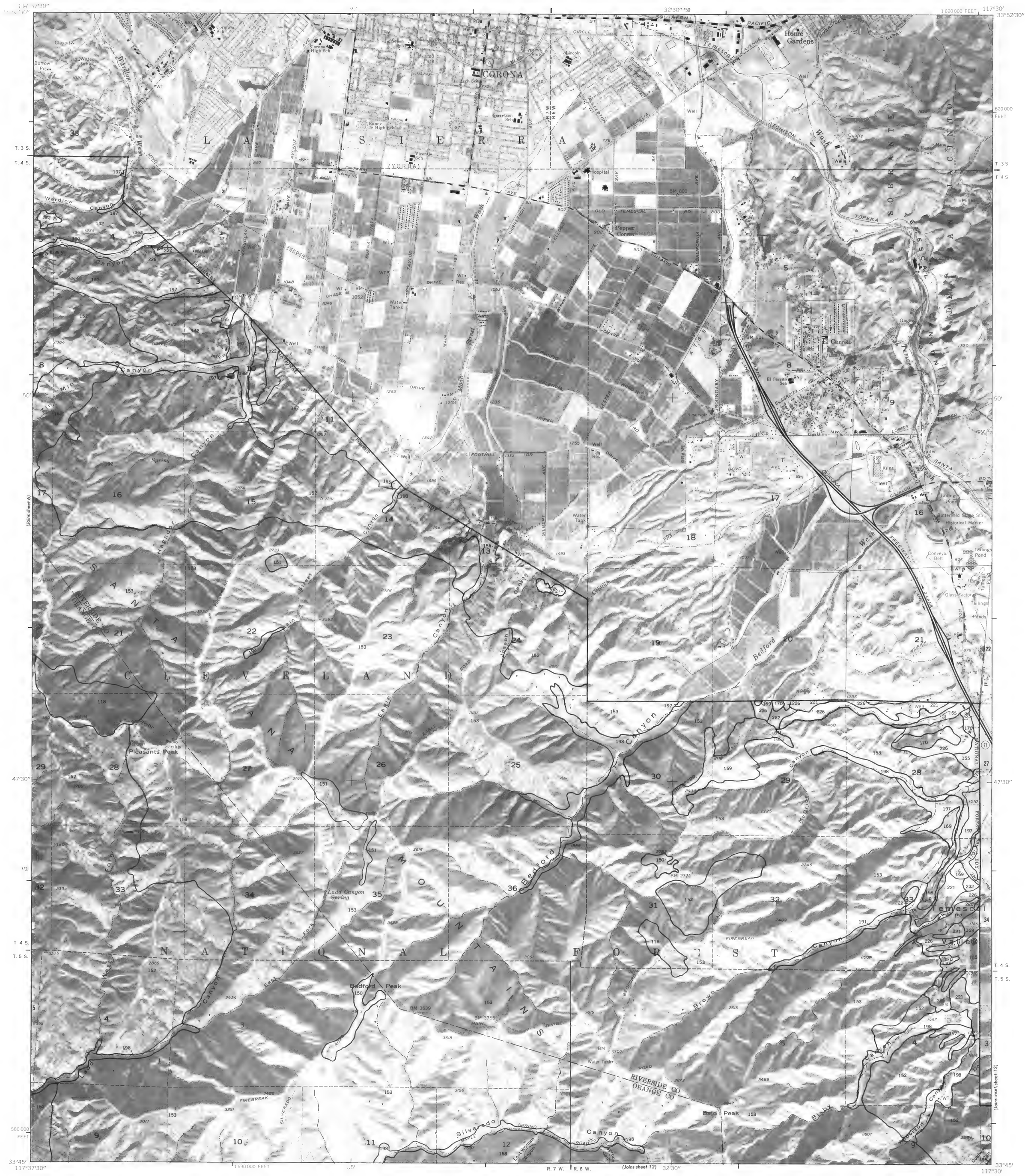
Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet
Scale 1:24 000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

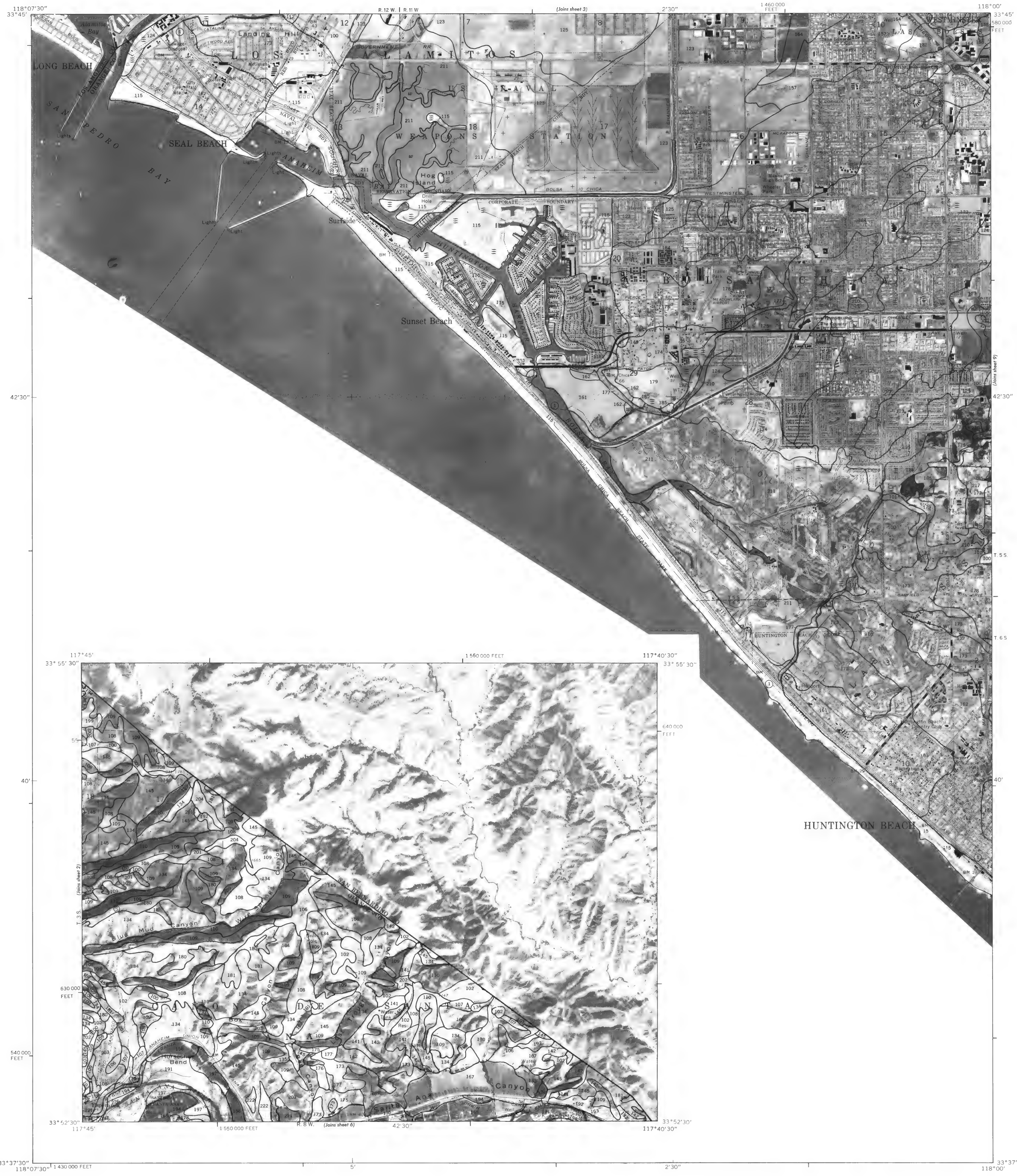
ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 6



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

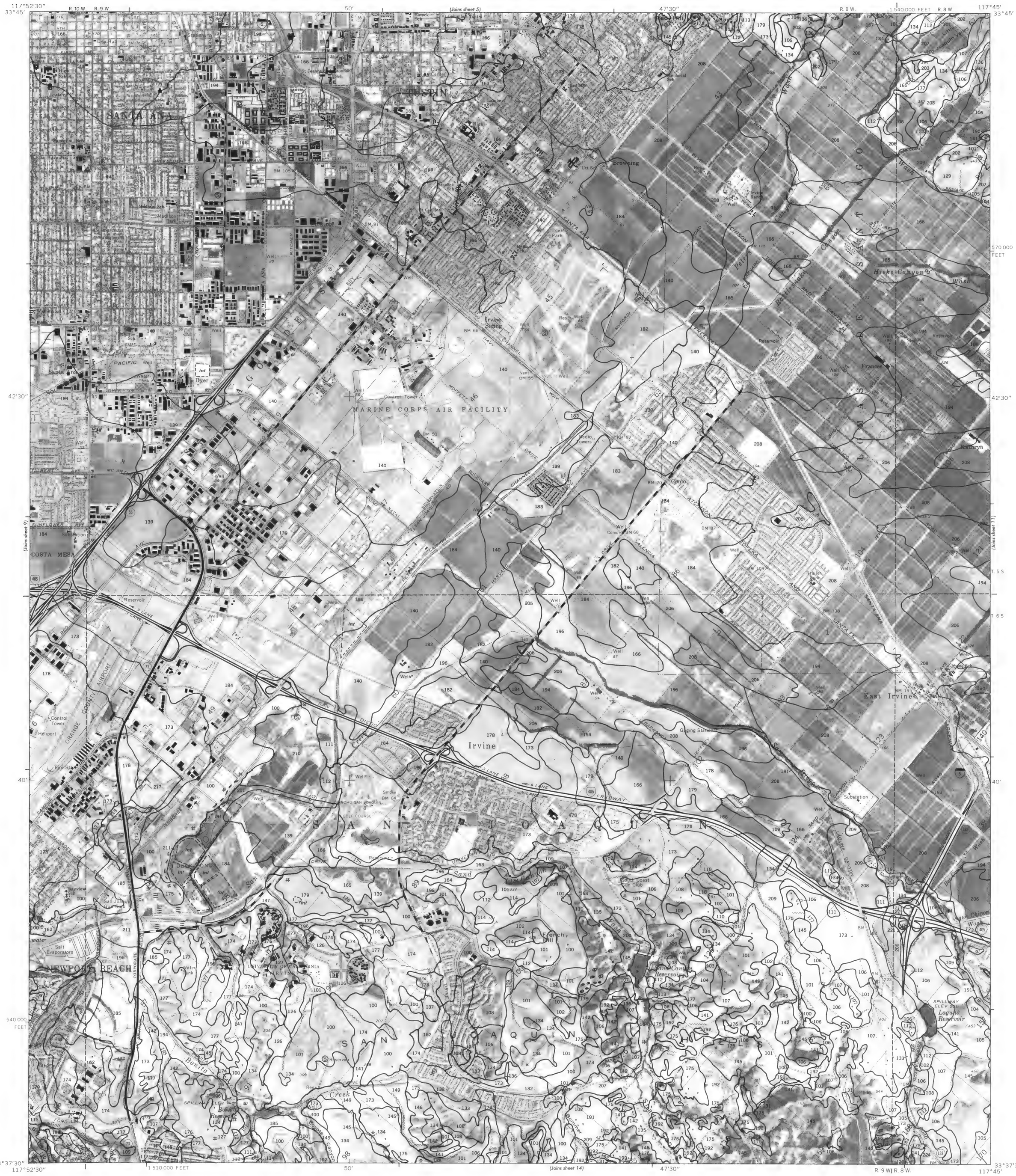
1 ¾ ½ ¼ 0 1 2 Miles
5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 8

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

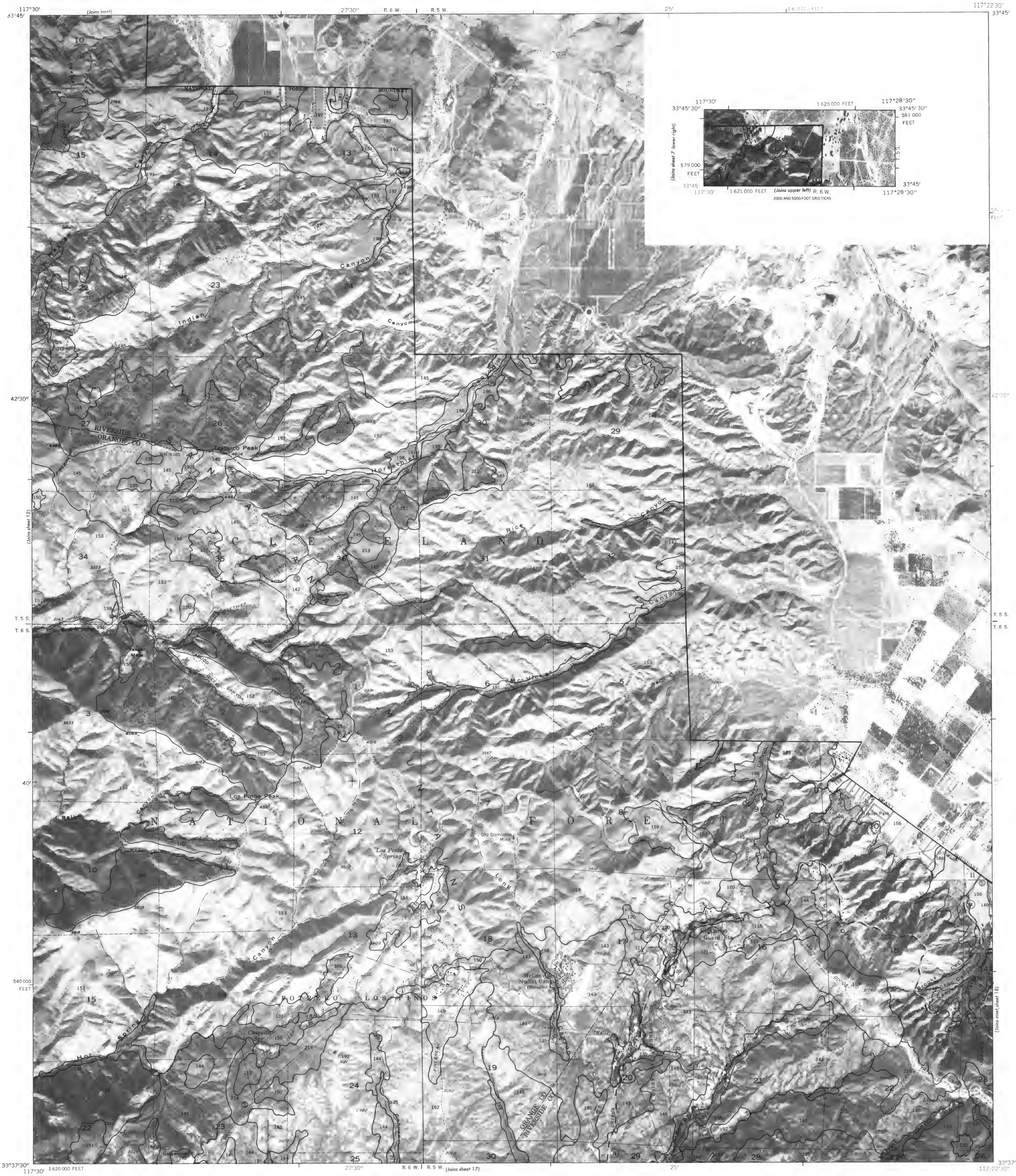
ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 11

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 12

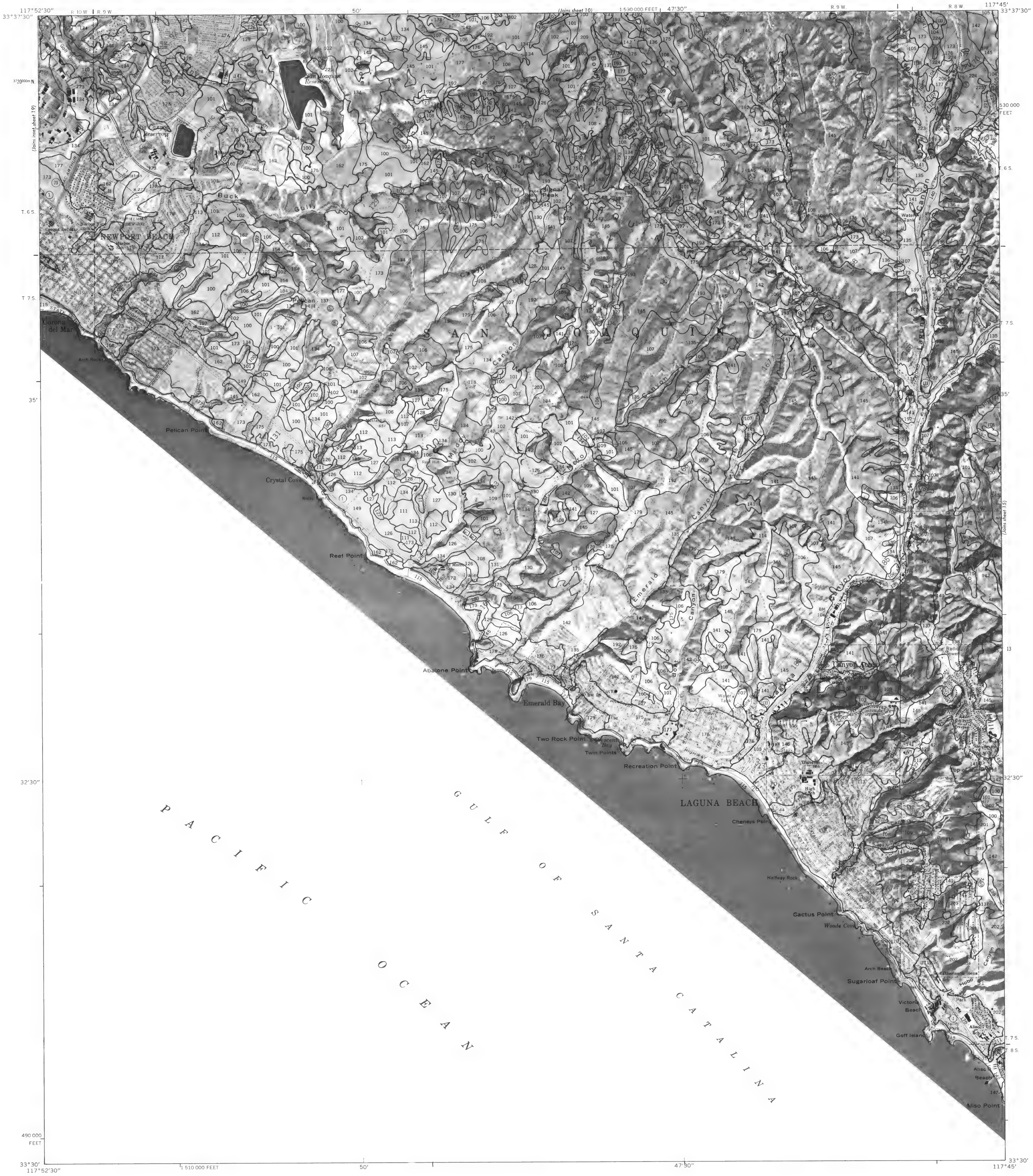


This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

ORANGE & WESTERN PART OF RIVERSIDE COUNTIES, CALIFORNIA NO. 13



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

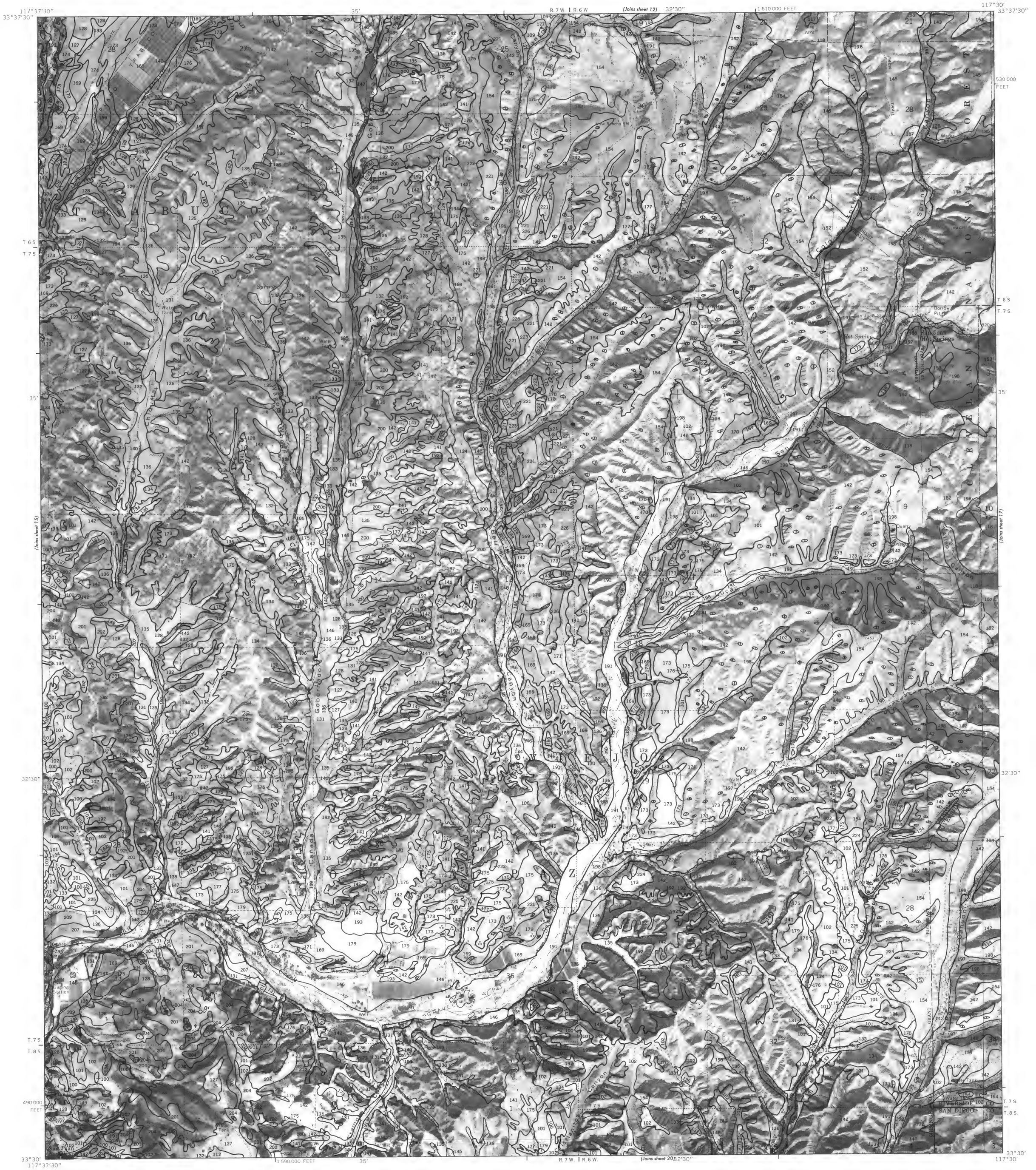
1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



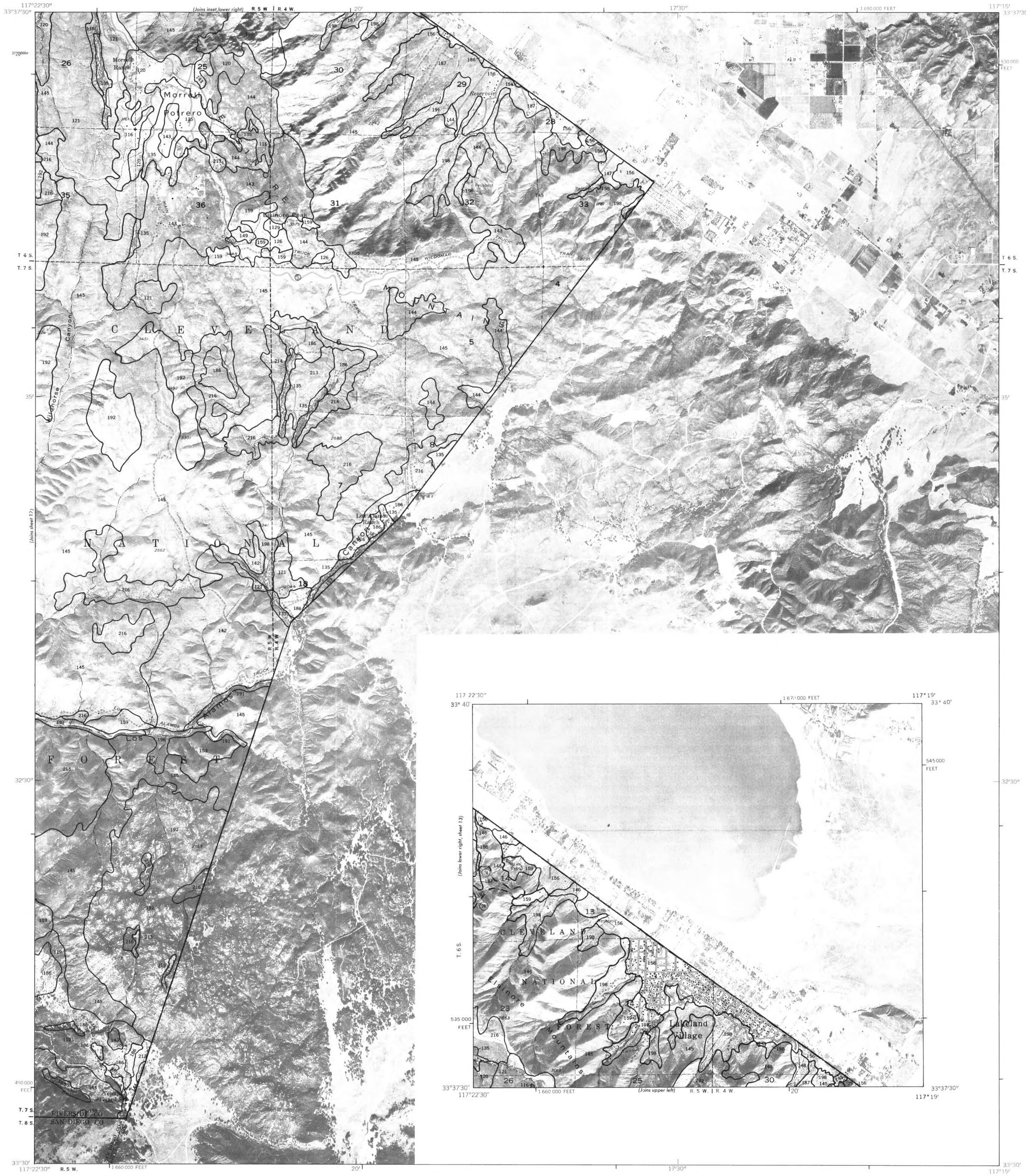
This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.

This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

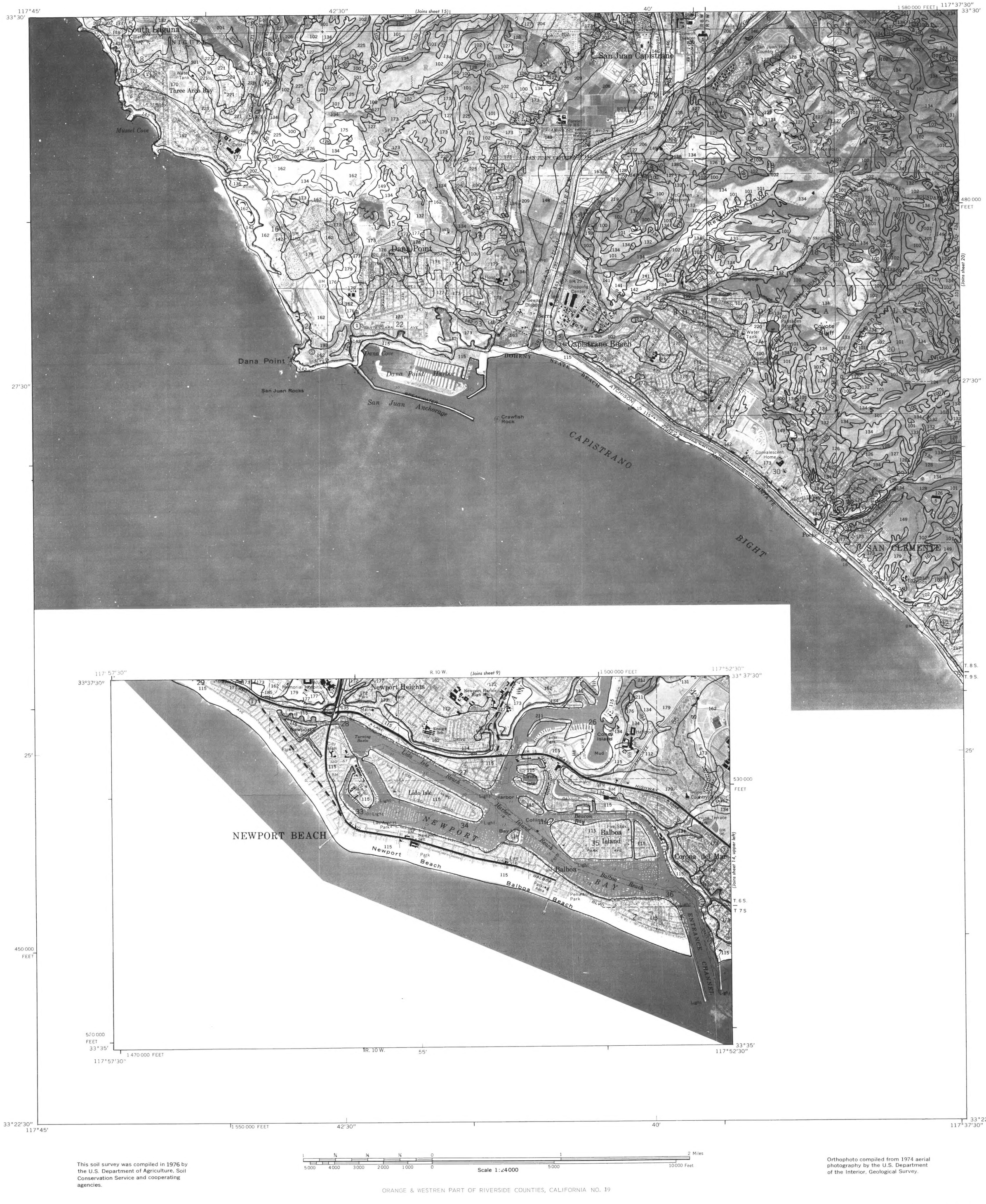
Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ¾ ½ ¼ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10000 Feet
Scale 1:24000

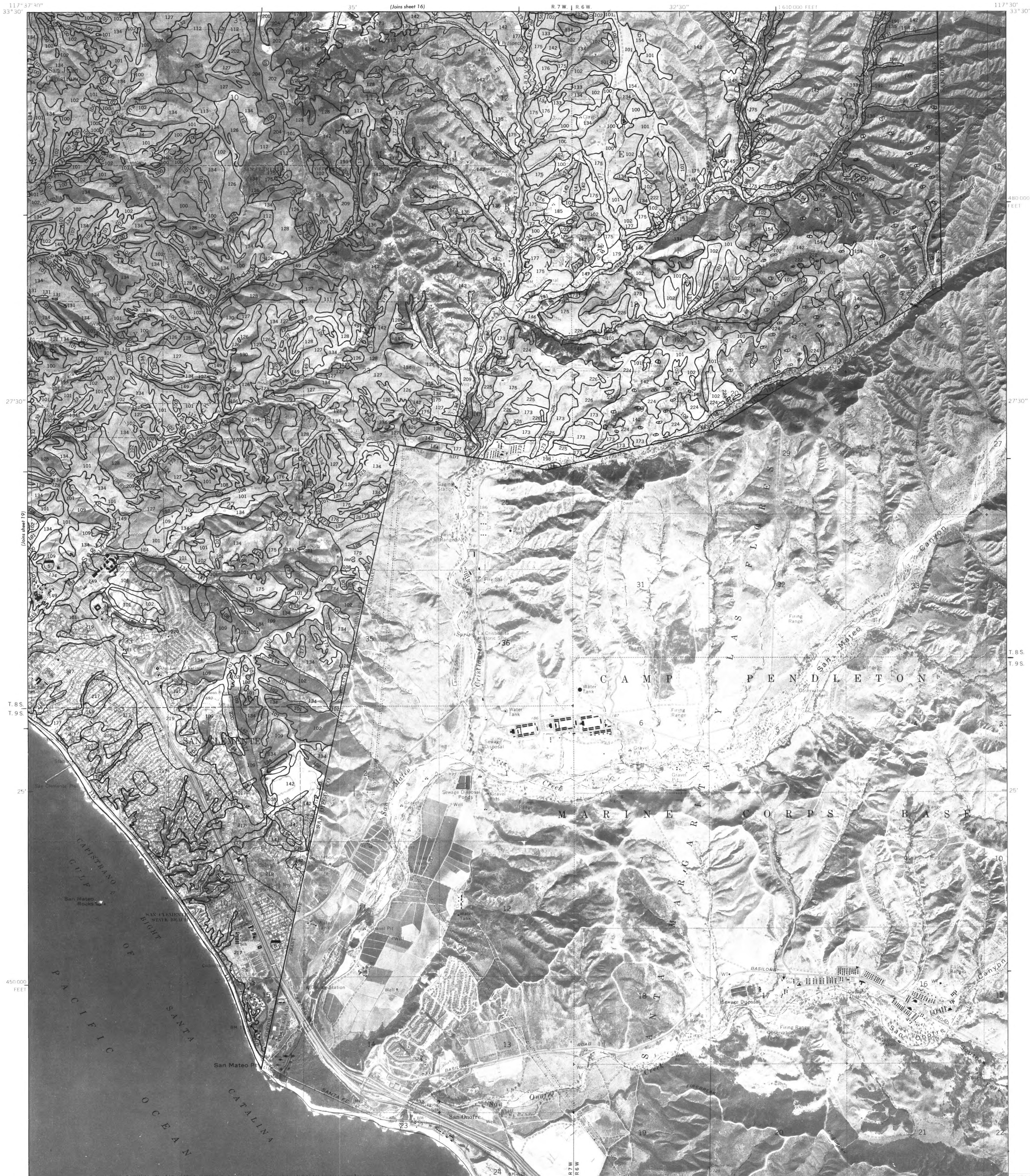
Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.



This soil survey was compiled in 1976 by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

1 ½ 0 1 2 Miles
5000 4000 3000 2000 1000 0 5000 10 000 Feet
Scale 1:24000

Orthophoto compiled from 1974 aerial photography by the U.S. Department of the Interior, Geological Survey.